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GROWING EXPORTS.

Our last summary of electrical export trade showed that throughout the year ending June 30 there had been a steady gain month by month in the totals, but with a lagging behind as to heavy electrical machinery. We have now the figures for July, and it is gratifying to find that whether as to instruments or machinery, an advance over previous figures is apparent. The export of heavy electrical machinery for July, 1910, is not less than $745,419, as compared with $391,195 in July of the previous year. This is a remarkable gain of nearly 100 per cent, and indicates a very brisk revival of foreign demand. In electrical instruments and apparatus the gain is not less gratifying. This year in July the amount was $839,059, as compared with $567,795, so that here again a much better demand is to be noted. The two items, together, amount to $1,584,378, as compared with $958,990. It seems unquestionable that dullness and depression prevailed in the electrical industry during the later summer months, but, as these figures prove, the slackness certainly did not affect the export trade.

Analyzing the data it cannot be said that the gains were widespread. On the contrary, they were "spotty," but they came from quarters where of late little desire for American goods had been shown. The most spectacular instance is Japan, which in July, 1909, took $1,132 in heavy stuff, but which took this July a quantity valued at $168,019. A more violent contrast could hardly be presented. The larger amount may be due to Japanese trolley and transmission enterprises now being pushed and marking the initial stages of recovery from the frightful effects of the war with Russia. In like manner, Mexico jumped from $48,486 to $135,026, and Canada from $86,199 to $149,529. Mexico also doubled its purchases of light material, from $65,072 to $120,607, while Japan increased from $78,935 to $102,185. A few more gains of this character would soon leave all previous records far behind and in the shade, offsetting such losses as with France, which country in July, 1909, took $125,918 in heavy electrical machinery, but which in July, 1910, took $6,233. Of course, individual orders of some bulk account largely for such an exhibition, but nobody wants a load curve of that kind if it can be helped. On the whole, export conditions seem to be more hopeful and satisfactory than for many years past.

Just as we go to press the figures for August have come to hand. These we are glad to note maintain and accentuate the upward tendency observed in July and lift the curve higher in a steady sweep. The export in August of heavy electrical machinery was $708,100, as compared with $448,976 in August, 1909, while the export of electrical instruments was $852 958, as compared with $590,864. These are most gratifying gains, making a total of $1,561,058 against $1,039,840. Thus there is an increase of over half a million in the single month. It is, moreover, observable that the gains are quite evenly distributed, except that Mexico shows up very strongly under both heads,

with a spurt of buying which carried her total purchases from $97,280 to $316,901. We would like to see our other customers triple their requirements in the same way.

ADJUSTABLE-SPEED ALTERNATING-CURRENT MOTORS.

As a competitor of the constant-speed, shunt-wound, direct-current motor, the polyphase induction motor has in general proved highly advantageous, both by reason of its simpler mechanical construction and on account of the higher efficiency and better economy with which it can receive energy from high-voltage transmission circuits. Where only constant-speed service is desired the polyphase induction motor operates with mechanical characteristics that are in many respects ideal; but where variable speed or adjustable speed is desired the induction motor, considered alone, is at a considerable disadvantage when compared with the series-wound or the adjustable-field, direct-current motor. However, where the conditions are such that all energy is received over high-tension circuits, and the use of direct-current motors would involve the installation and operation of extra machinery for converting to direct current, the disadvantages of the induction motor are more than balanced by the decrease in efficiency and increase in cost of equipment and operation incident to the employment of direct-current machinery.

A case of the kind just mentioned is outlined in an article by Mr. R. E. Hellmund in this issue. The author shows that an induction motor especially designed for four different speeds possesses mechanical and electrical characteristics which render it a worthy competitor of the series-wound, direct-current motor and the accompanying converting machinery for receiving energy from high-potential transmission circuits. The induction motor discussed is provided with two separate primary windings, each arranged for pole changing in the ratio of two to one. When operated as proposed by the author, its mechanical and electrical characteristics are identical with those of a direct-current, shunt-wound motor equipped with two separate armature windings with individual commutators upon which may be impressed two different values of voltage. That is to say, the machine is an "adjustable-speed" motor, and in performance resembles the double-commutator, two-voltage, direct-current machine. Moreover, in constructive material it would compare with the ordinary induction motor somewhat as the double-commutator shunt machine compares with the single-commutator series motor. In whatever service the former can be substituted for the latter, the four-speed induction motor can be used with equally satisfactory performance, combined with the highly desirable elimination of all converting apparatus.

In comparison with the direct-current motor of either the constant-speed, adjustable-speed or variable-speed type, the induction motor retains the desirable feature of being without a commutator. The most unsatisfactory detail of the single-phase series motor is its commutator, but numerous schemes have been used with more or less success for suppressing the sparking, and in many respects this machine operates almost as satisfactorily as the direct-current series motor. It would seem that, for the service outlined by the author, the single-phase series motor should be preferable to the four-speed induction motor. Moreover, the known characteristics of the polyphase commutator motor, which has reached scarcely more than the experimental stage, are such that it offers highly inviting possibilities for just such purposes as those for which the author suggests the use of the four-speed induction motor. It is not too much to expect within the next few years a rapid development of the alternating-current commutator-type motor, which is likely to supplant the direct-current motor in installations where all of the energy is received over high-tension transmission lines, and where variable-speed or adjustable-speed work forms only a small part of the whole service needed.

THE LIGHT OF THE FIREFLY.

Our readers will remember the interesting research by Messrs. Ives and Coblentz regarding the light of the firefly published a year ago and tending to confirm the judgment of Langley regarding the efficiency of light production. In the current issue Dr. Ives reports a continuation of the work with reference to clearing up some of the dubious points of the earlier investigation. Briefly, the matter in question was as follows: The light of the firefly as studied photographically showed practically just what the visual studies of Langley disclosed, that the light emitted is practically confined to the most luminous part of the visible spectrum. Of course, the photographic method was incapable of showing the existence or non-existence of infra-red radiations, which, if they existed, would tend greatly to reduce the efficiency of the light-producing process. Langley had shown that there were no material radiations of very great wave length, but a considerable gap remained between the visible band and the region in which it was certain that radiations did not exist. The region concerned is one far from easy to investigate, and the method taken by Dr. Ives was to fall back on the phenomena of phosphorescence which is excited by so-called actinic rays in certain substances, but may be extinguished by red or infra-red rays. This reducing power of infra-red rays should, if these rays existed in the light of the firefly, show their existence. Dr. Ives found no evidence of any radiation from the firefly between that visible to the eye and a region well into the infra-red, nor in extending the photographic operations was there any evidence of ultraviolet activity. The region investigated by phosphorescence does not cover the whole dubious space left by Langley's investigations, but it covers so considerable a part of it as to render the existence of any considerable amount of radiation from the firefly somewhat unlikely.

The results, therefore, tend strongly to confirm the conclusions of the previous investigations, that the firefly actually does produce radiation of a very high order of efficiency, confined to a narrow region of the visible spectrum—that region in fact which is of the highest luminosity so far as the human eye is concerned. It is singular enough to find nearly monochromatic radiation from a living organism, but it is doubly curious to find that radiation of the wave length to which the human retina is most sensitive. The interpretation of the fact is dubious. At first thought it would certainly indicate a strong probability that the photochemical substances concerned in vision are substantially the same in all classes of eyes, including those of insects like the firefly. From an evolutionary standpoint and bearing in mind the fact that all organisms have been evolved under sunlight, this point of view would seem reasonable, but it certainly opens up a wide field for investigation. Especially it would seem worth while to examine the various species of fireflies and other light-producing organisms to find out what range of variation in color may be

observed in the light emitted. That there are such variations from species to species seems pretty well established. Particularly should such researches be made with reference to the behavior of the light-producing bacteria, the study of which gives apparently a better chance for the investigation of the photochemical processes concerned than is possible in the case of the other more complex organisms like the firefly.

THE ISOLATION OF AN ION.

Most observers, be they astronomers or not, usually recognize a sensation of solitude and isolation when contemplating the majesty of the starry heavens. This is the isolation of the immensely great. In another way, the contemplation of a single ion and its segregation produces a sense of isolation of the immensely small. In regard to mass a single ion is estimated to be about 7×10^{-28} gm., or a mass which bears approximately the same ratio to that of an ordinary pocket pencil, weighing 2 gm., that the mass of the pencil bears to the mass of the whole earth. We cannot see a molecule of any substance, even with the aid of the most powerful microscopes yet produced. With the aid of the so-called ultra-microscope it is believed that interference images are produced on the retina by particles of matter not much larger than certain big and unwieldy complex chemical molecules. But the mass of the ion is supposed to be about 2000 times less than that of an atom of hydrogen, the smallest acknowledged atom, so that our present expectation of being able to see an ion is ultra-microscopic.

Recently, however, certain experiments have led to the belief that ions can be counted one by one like sheep, not by seeing them, but by seeing the electrical effects which they individually produce. This is equivalent to convicting ions on circumstantial evidence. A paper by Prof. R. A. Millikan on this subject has recently been abstracted in *Science*. The method employed droplets of oil, created by an atomizer, and allowed to fall through a pinhole into a circular air chamber 20 cm in diameter. The floor and ceiling of this chamber were flat plates of brass, separated from each other by insulators 1.6 cm high. The air in this chamber is carefully protected from draughts. After one or more oil droplets have chanced to fall through the pinhole this aperture is closed. Such droplets may have a radius of about 1μ. They cannot fall rapidly, owing to the viscosity of the air. They may take a minute or more to fall 1.6 cm from ceiling to floor. By means of arc-light illumination the slowly falling droplet can be seen and watched, through a telescope, as a bright speck on a dark background. The droplets are always initially charged, by atomization, and when they have nearly reached the floor they can be raised against gravitation through electrical force by applying an electrical difference of potential to the floor and ceiling plates of the chamber. The droplet then reverses its motion and rises like any small electrified pith-ball. When it has nearly reached the ceiling the electric charge is removed from the plates, which are then short-circuited, and the droplets fall again by gravitation.

This process of electro-gravitational battledore-and-shuttlecock can be continued indefinitely. The times of rising and falling past the cross-wires of the telescope may be recorded. The times of falling are stated to be identical, for the same droplet, within the errors of observation, but the times of rising are not always the same. They may be the same for half a dozen successive ascents, and then the lifting speed will change suddenly. On computing the cause of the changes in ascending velocity, it is reported that they can only be due to changes in electric charge. These charges are always taken on during gravitational descent and they are always simple multiples of 4.9×10^{-10} electric units of quantity, about the size of the supposed ionic charge. Consequently it is inferred that the droplet swallows up neighboring free ions during its descent, and compounds their electric charge with that which it previously held, hence the change in the subsequent lifting force.

IMPEDANCE PARADOXES.

An arrangement of electrical circuits giving results differing from what would probably be expected was described in an article by Prof.. F. M. Denton which appeared in our issue for Aug. 11. The author showed that in a circuit consisting of a non-inductive resistance in series with, say, an inductive reactance, the impedance may be increased by shunting the reactance with a resistance. This relation is interesting and is rendered none the less so by reason of the fact that its existence has been known for some time and it has been described in certain text-books used in England. The author employed a method of demonstration characterized by lack of the many complications that would ordinarily be introduced in dealing with such a circuit problem.

Our present issue contains a communication from Mr. H. F. Hagen in which is given a more general solution of the problem as outlined for certain limited conditions by Professor Denton. The author develops an equation showing the relations which must exist in order to permit the impedance of the circuit to be increased by shunting a certain portion thereof. He finds that when the resistance which is to be placed in shunt with the reactance portion of a series impedance circuit has a certain "critical" value, the impedance of the circuit will be increased no matter how small or how large may be the values of the resistance or reactance of the series circuit. The author's treatment might lead one to believe it to be possible to find a value for the shunting resistance such that an increase in impedance would take place for any value whatsoever for the series impedance or its components. However, attention should be called to the highly significant fact that the "critical" value upon which the author's treatment is based depends wholly upon the relation of the components of the series impedance to each other and to the shunting resistance so that the shunting resistance ceases to have its "critical" value when either component of the series impedance is altered.

In connection with the above-outlined "impedance paradox," mention may be made of a second interesting circuit relation, which likewise is not entirely novel. This relation is that existing when the field coil of a compensated single-phase series motor is shunted with a condenser. The circuit is that of an apparent resistance in series with an inductive reactance; the apparent resistance increases in value with the increase in the capacity of the condenser in shunt with the field coil. When the condensive reactance equals the inductive reactance, the apparent resistance has infinite value, yet a definite current of practically unaltered value continues to exist in the field coils, the return circuit being locally through the condenser. The conditions here assumed are ideal, but they can be closely approximated in practice.

Illuminating Engineering Course at Johns Hopkins University.

An attendance of over ninety is already registered for the course of lectures on Illuminating Engineering to be given at Johns Hopkins University, Oct. 26 to Nov. 8, under the joint auspices of the university and the Illuminating Engineering Society. A number of colleges maintaining courses in electrical engineering are planning to send representatives to attend the lectures, some of which institutions contemplate founding undergraduate courses in illuminating engineering. There will be a considerable representation from central-station and gas companies, some of the former proposing to send as many as ten members of their technical staff. Consulting engineers, and shade and fixture designers will also be represented.

Those planning to attend the course should forward their applications to the secretary of the Illuminating Engineering Society, 29 West Thirty-ninth Street, New York, or to the university, within the next week, in order that the university may definitely know the number of attendants for whom classroom and laboratory facilities must be provided.

As previously stated in these columns there will be thirty-six lectures, embracing every subject included in electrical engineering. The lecturers include the principal authorities in this country in the various subjects, and form perhaps the most authoritative body of men representing applied science that has ever appeared in a university course in this country.

The officers of the Illuminating Engineering Society are formulating plans for a formal opening of the lecture course, which will take place on Tuesday, Oct. 25. A number of representative men connected with the lighting interests will be present at this time, including the presidents of several of the national professional bodies interested more or less directly in illumination and illuminants.

American Manufacturers' Export Association.

An association said to represent more than $250,000,000 capital has been formed by American manufacturers for the purpose of increasing export trade.

The chief objects of the association are as follows:

1. To bring united influence to bear on the State Department and the Department of Commerce and Labor in Washington looking to the advancement of our foreign trade interests.

2. To bring similar pressure to bear on transportation companies looking to the establishment of equitable freight rates and better service.

3. To protect trade marks of American manufacturers by combating the common practice of unscrupulous foreign firms or individuals in registering and doing business under trade marks not rightfully their own.

4. To look out for those members who get into the meshes of customs authorities, aiding them in reaching an equitable adjustment of their difficulties.

5. To combat the many evils now existing in the field—evils which thrive on the general ignorance of business conditions—and to take steps toward the elimination of concerns whose crooked export methods are reflecting discredit on the entire nation, and who now operate with little or no fear of interference. United action by members would speedily reform these conditions.

6. To enhance the dignity and standing of the manufacturers making up this association in the eyes of foreign importers and large foreign buyers generally, to whom membership in the proposed association will be an indication of good general standing in the business world.

7. To dignify, broaden and render more effective the great work that is now being done by individual export managers by bringing them together periodically for their own good and for the good of the houses they represent.

8. To investigate, for the benefit of members, organizations purporting to exist for the purpose of aiding the American manufacturers, such as publications and bureaus.

9. To secure the proper interpretation of foreign customs regulations, resisting unfair or ignorant constructions thereof which an individual shipper could not afford to fight, but which the association could resist as matters of precedent and principle.

The president of the association is Mr. W. B. Campbell, of the Perkins-Campbell Company, Cincinnati, Ohio. One of the directors is Mr. Maurice Coster, of the Westinghouse Electric & Manufacturing Company.

Montreal Lighting Controversy.

The arbitrators, experts and lawyers asssembled in the City Court House at Montreal on Oct. 4 to proceed with the hearings in the controversy between the local lighting company and the city, which have extended over three months. Again the counsel for plaintiff and defendant united in asking a further adjournment to permit the continuance of negotiations looking to a settlement of the differences, and the arbitrators consented to a three weeks' adjournment, or until Oct. 26.

Since the last meeting of the arbitrators, held the day after the opening of tenders for a ten-year contract for city lighting, the board of control and City Council have passed the necessary resolutions awarding a contract to the Montreal Light, Heat & Power Company for a period of ten years, for all arc and incandescent lighting and energy that may be required by the municipality at the prices tendered, which are as follows:

For 6.6-amp arcs, $72.70 for the total number, or ranging up to $91.50 for 500 lamps or less. For 4-amp lamps, $63.15 and $82.26, respectively. For 40-cp and 80-cp tungsten lamps, $16 and $23 per year, respectively. For lighting the buildings by meter, 5 cents per kw-hour for all the business, with increasing rates for less proportions. For 2200-volt alternating-current energy, $25 per horse-power per annum in units of 150 hp and over.

To comply with the terms of the new contract the Montreal company has already issued specifications and is taking bids for magnetite-arc lighting apparatus. There will be installed at once about 500 6.6-amp and 1200 4-amp magnetite lamps with regulators, rectifiers, etc. In view of this re-establishment of amicable business relations between the city and the Montreal company, it is but natural both sides are deeply interested in settling the old claim, approximating $250,000, of the company against the city, especially as both the city's and company's expenses in the matter of arbitration are being said to aggregate nearly $1,000 per day for each day the arbitrators sit.

The board of control at its meeting on Monday of last week took the matter of settlement under serious consideration, and as it is understood that the company's representatives are in an approachable mood, especially since the return from Europe last week of Mr. H. S. Holt, president of the Montreal Light, Heat & Power Company, an early adjustment of the matter is expected.

Single-Phase Railway for Sweden.

In the electrification of the Swedish railroad between Kiruna and Riksgraensen use will be made of the 15-cycle, single-phase system with an e.m.f. of 15,000 volts at the trolley.

The main transportation over the railroad is represented by the haulage of iron ore to the Norwegian frontier at Riksgraensen. The ore trains are unusually heavy, the total weight being more than 2000 tons. Each train of this weight will be hauled by two locomotives, each equipped with two 1000-hp motors. These 4000-hp locomotives will be among the largest ever constructed.

There will be a certain amount of passenger traffic, which will be handled by means of express trains, each of which will be provided with a single 1000-hp locomotive, designed for a speed of 100 km (62 miles) per hour.

The hydroelectric generating station will be located at Porjus Falls, 120 km (75 miles) from Kiruna and 130 km (80 miles) from Riksgraensen. The station will be equipped with three

10,000-kva, single-phase alternators. The energy will be transmitted at an e.m.f. of 80,000 volts to four transformer substations, where the e.m.f. will be reduced to 15,000 volts.

The contract, which has been let to the Siemens-Schuckert-Werke, Berlin, Germany, and the Allmaenna Svenska Elektriska Aktiebolaget, Westeras, Sweden, calls for the completion and operation of the line in the latter half of 1914. According to the official estimate the total amount involved in the undertaking will be about $4,000,000.

Telephone and Gas Rates in Chicago.

As already related in these columns, the committee on gas, oil and electric light of the City Council of Chicago is studying the question of a possible revision of telephone rates for the city, as the time when such revision may be made under the existing ordinance is drawing near. An elaborate report on the cost of telephone service by the Chicago Telephone Company in Chicago for the year ended March 31 last, under the ordinance of Nov. 6, 1907, has been made to the city comptroller by D. C. & W. B. Jackson, engineers, and Arthur Young & Co., certified public accountants. This report is in turn being analyzed by experts retained by the City Council committee, of which Alderman W. J. Pringle is chairman .

Another important subject to which the committee on gas, oil and electric light is devoting its attention is a possible revision in the price of illuminating and fuel gas. The present net rate to consumers is 85 cents per 1000 cu. ft., and by the existing ordinance this rate will obtain until Feb. 25, 1911. Meantime, the committee will make a study of the subject and report whether, in its judgment, the People's Gas Light & Coke Company can afford to make a lower rate.

At the meeting of the City Council on Oct. 3 Alderman Pringle presented a request from his committee that an appropriation of $10,000 be made to carry on its work of investigating telephone and gas rates. This request was referred to the finance committee.

Convention of the American Street & Interurban Railway Association.

The annual convention of the American Street & Interurban Railway Association and its affiliated Accountants', Engineering, Claim Agents' and Transportation and Traffic Associations opened at Atlantic City, N. J., Oct. 10, with meetings of the Transportation and Traffic Association and the Claim Agents' Association. During the morning the delegates and guests were registered and received badges at the booth at the entrance to Young's Million Dollar Pier. The meeting of the claim agents was held in the Traymore Hotel on the Boardwalk and the transportation and traffic men met in the Greek Temple on the convention pier, both sessions being held in the afternoon. The usual addresses and reports were presented at the two meetings and a paper, entitled "Creation of Passenger Traffic," by Mr. J. F. Keys, of Detroit, Mich., was read before the traffic association. Mr. E. C. Carpenter, president of the Claim Agents' Association, was unable to be present at the meeting of that body, and Mr. J. S. Harrison, the vice-president, presided. Owing to the absence of Mr. J. R. Pratt, of Baltimore, Md., his paper on "What Matters Particularly Interesting to Claim Departments Ought to Be Subjects of Legislation and How Can the Claim Agents Best Exert Proper Influence to Obtain Such Legislation" was not read at the first session.

That portion of the pier occupied by the Manufacturers' Association and devoted to exhibits is very attractively decorated. An open lobby is left in front of Building No. 1 for reception purposes. The booths around this space are designed especially for artistic effect with pergolas flanking the central booth. The pergolas are draped and decorated with vines and serve to set off the exhibits to advantage.

On Monday evening the annual reception in honor of the presidents and other officers was held in the ballroom on the convention pier. Dancing and refreshments followed, interspersed with songs by a quartet of ladies. On Tuesday afternoon a psychic entertainer and comedienne occupied the attention of the ladies in the solarium of the Marlborough-Blenheim Hotel. Other entertainment features on Tuesday were a smoker, entertainment and indoor baseball game between the railway men and supply men in Marine Hall on the convention pier in the evening, and a progressive euchre party for the ladies in the ballroom of the Marlborough-Blenheim Hotel.

On Tuesday morning the accountants met in the Annex Court Hall, the Engineering Association in the Aquarium Court Hall and the transportation men in the Greek Temple on the convention pier, while the claim agents held a meeting in the Traymore Hotel. In the afternoon the parent body met in the Greek Temple, and the accountants and engineers met in the Aquarium Court Hall, the claim agents meeting, as usual, in the Traymore. The attendance as we go to press promises to be the largest on record.

In his address before the parent association, Tuesday, President James F. Shaw, of Boston, dwelt on the work of the association during the past year. He cited the need of cooperation between the state, sectional and the national bodies and mentioned the arrangements made for the interchange of information pertaining to legislation in the various states. The work of the various affiliated bodies was briefly summarized. Mr. Shaw dwelt on the part played by the association in the sound development of the industry and on the remedial measures suggested last year to enable the electric railways of the country to fulfil the due measure of service demanded of them by the public. The closing sessions will be held on Friday afternoon.

Ohio Telephone Situation.

It is believed in Cleveland that some understanding has been reached between the dissatisfied independent telephone faction and J. P. Morgan & Company whereby the suits instituted months ago to prevent the transfer of stock of the Cuyahoga and United States telephone companies to the firm will be dismissed. This belief has been strengthened somewhat by the conferences that have been held in Cleveland the past few days and the fact that buying orders for the securities were received from a number of Eastern houses.

Mr. H. B. McGraw, attorney for the parties who brought the suits, has asked that J. P. Morgan & Company be dismissed as party defendants in the suits, and the request for the appointment of receivers for the companies was withdrawn. This is looked upon as further evidence of a compromise of some kind. It will be recalled that Mr. Morgan and his associates were alleged to be the agents of the American Telephone & Telegraph Company in the petitions. J. P. Morgan & Company filed an answer to the allegations some days ago, in which it was denied that they acted as representatives of this company and asserted that the securities were purchased as an investment, the same as any other securities would be. The answer further stated that the firm would do everything possible to aid the companies in which it is interested and that the properties will all be put into the best shape for satisfactory operation.

Electrical Inspection from the Fire Underwriter's Viewpoint.

At the annual convention of the Fire Underwriters' Association of the Northwest in Chicago, on Oct. 6, Mr. George E. Bruen, of New York, engineer and superintendent of the electrical department of the National Board of Fire Underwriters, read a paper on "Theory and Practice in Electrical Inspection." The speaker told how the National Electrical Code came into being in 1892, and he said that the Code represents to-day "the best thought of all the more important and influential electrical engineers of the country." A fundamental principle underlying

the code is the minimization of the cost of insurance on such buildings as are wired and electrically equipped in accordance with the rules laid down.

Mr. Bruen said that any electrical inspection department for fire underwriters must first be governed by a clear conception of its duty to the insurance companies, but having fulfilled this, there remains a degree of responsibility toward the assured, who is to be protected "from the incompetent electrical contractor, as well as from the errors which will inevitably be made by the employees of the best electrical concern; and, furthermore, toward the electrical contractor himself, whose co-operation is to be sought, and whose education, in the full intent and meaning of the National Electrical Code, is to be fostered and encouraged." Care should be taken in the selection of inspectors. A comprehensive scheme should be worked out to bring the home office of the electrical inspection department into the closest contact with the electrical contractor in the field.

The speaker described the methods employed by the National Board of Fire Underwriters in the local territory which is inspected from the office of that board. In the usual routine inspections are made only upon receipt of written applications, signed by the electrical contractor who is employed to install the wiring or by the assured himself. These applications are card-indexed for future reference, and the originals are placed in the inspector's hands. The inspector proceeds to make a report, which is checked over by the chief inspector. A letter is then written to the contractor, giving him a verbatim copy of the report. In case the equipment is seriously hazardous, a copy of this letter is forwarded to the assured. Further inspections during the progress of the work are made only on written order, received, as a rule, from the contractor. If such notification is not received within a reasonable time, a letter is mailed to the assured to advise him of the condition of the work at the last inspection. Usually this action meets with the appreciation of the assured, who generally gives attention to any defects or unfinished details. When the inspector finds that the entire electrical equipment is complete and in accordance with the rules, he makes a report to that effect and a certificate of approval is issued and forwarded to the assured.

Another class of applications is that relating to requests for the inspection of alterations, repairs or additional work in buildings already wired. In such cases the existing certificate covering the original installation is endorsed to cover the approval of the additional work. But if it is found that the original equipment is out of repair or has become hazardous, an "old-work report" is attached to the approval for the new work. The contents of this report are communicated to the assured, with the suggestion that repairs and corrections should be made, in order to safeguard the building against possible loss or damage by fire.

The issuing of a certificate to cover such buildings as have been approved in relation to their electrical equipment is regarded by Mr. Bruen as especially important. As the public becomes educated, it will demand such a certificate as a condition of any contract made with electrical contractors. The certificate should bear a clause to the effect that no alterations after its date shall be made without the consent of the board of fire underwriters. This clause is seldom, if ever, enforced by insurance companies in the event of a fire loss; yet it has a deterrent effect upon the assured, who will usually order an inspection of additions when made. It is the practice of the National Board of Fire Underwriters to re-inspect old equipments as frequently as possible without undue expense.

In closing Mr. Bruen spoke of the invaluable co-operation of electric light companies and of electrical contractors, as well as of architects and builders. With all these factors tending toward the desired end, he believes that diligent effort will reduce the number of fires from electrical causes almost to the vanishing point. Furthermore, in buildings in which the electrical equipment has not been disturbed by unauthorized and unskilled persons, a degree of security should be obtained which will show that a standard electrical equipment is the safest means of supplying and distributing light and power that engineering science has thus far been able to devise.

Annual Meeting of the Empire State Association.

The sixth annual meeting of the Empire State Gas and Electric Association was held in the United Engineering Societies Building, New York, on Oct. 5. In the absence of the president and vice-president the meeting was called to order by the second vice-president, Mr. R. M. Searle, of Rochester. Mr. Searle explained that, following a custom which had been successful in the past, the meeting would be informal and no stenographic report of the discussions would be taken.

Mr. C. A. Graves, Southern New York Power Company, had suggested the subject of "Tungsten Street Lighting," and the discussion was opened by him. Rates charged for this service and operating problems and conditions arising in connection therewith were discussed by the following: Messrs. H. M. Beugler, Newburgh Light, Heat & Power Company; George L. Colgate, Canandaigua Gas Light Company; F. B. H. Paine, Niagara, Lockport & Ontario Power Company; James C. DeLong, Syracuse Lighting Company; Stuart Wilder, Peekskill Lighting & Railroad Company; J. T. Hutchings, Rochester Railway & Light Company; C. G. Durfee, Rochester Railway & Light Company; A. S. Ives, Poughkeepsie Light, Heat & Power Company, and M. Webb Offuff, Schenectady Illuminating Company.

A paper on the "Fundamental Principles of Rates" was then presented by Mr. J. T. Hutchings, general manager, Rochester Railway & Light Company. It described the extensive study which has been made of this subject by this company and outlined the conclusions reached. The presentation of the paper was followed by a joint discussion by Mr. John C. Parker, mechanical and electrical engineer, and Mr. H. C. Deffenbaugh, of the Rochester company. An abstract of the paper and its discussion will appear in another issue.

After the close of the morning session the delegates had lunch at the Engineers' Club. The afternoon session was called to order by Mr. M. J. Brayton, first vice-president.

Mr. Charles H. B. Chapin, the secretary, read the report of the executive committee. The report called attention to the various meetings which have been held in different parts of the State during the year, and have demonstrated the value of informal gatherings. The practice of holding these sectional meetings will be continued. The report also called attention to two matters of general interest which were brought up by the Public Service Commission of the Second District during the year. The first was the question of establishing a calorific standard for gas, and the second that of filing schedules of rates. The report stated that the executive committee had maintained steadily the policy of candor in all its dealings with the commissions, without attempt to suppress or misrepresent the facts and that it was believed that the commissions were pleased to have the co-operation of the companies under their jurisdiction in the solution of the many difficult problems which they were required by law to solve. The executive committee urged the members to make more use of the association by consultation with the secretary, officers or committees.

Mr. T. R. Beal, on behalf of the committee on taxation, submitted a report in which he called attention to ten changes in the tax law which had been passed at the last session of the Legislature and approved by the Governor. Only two, or possibly three of the charges applied directly to public-service corporations. Special attention was also called to the annual report of the tax commissioners transmitted to the Legislature on Feb. 7, 1910, with particular reference to the statements made by the commissioners of their method of determining special franchise assessments. The report also mentioned three court decisions which were of particular interest and the new federal corporation tax.

The committee called attention to a paper entitled, "Taxation of Telephone Companies in the State of New York," presented by Mr. Hugh Taylor at the National Conference on State and Local Taxation, held in Louisville, Ky., Sept. 1, 1909.

The nominating committee then submitted its report, and the following officers were elected for the ensuing year:

President, Mr. M. J. Brayton, secretary, Utica Gas & Electric Company; first vice-president, Mr. R. M. Searle, vice-president, Rochester Railway & Light Company; second vice-president, Mr. G. W. Curran, comptroller, Syracuse Lighting Company; treasurer, Mr. A. B. Beadle, vice-president, Bath Electric & Gas Light Company; secretary, Mr. Charles H. B. Chapin, New York City.

Mr. C. G. Durfee, of the Rochester Railway & Light Company, mentioned a change in the Public Service Commissions law which required that no type of electric meter should be installed which had not been approved by the commission. He stated that the meter committees of the National Electric Light Association and the Association of Edison Illuminating Companies had done a great deal of work on this subject and suggested that a committee be appointed to co-operate with the other two associations. The president will appoint a committee.

After the adjournment of the afternoon session a number of the delegates visited by invitation the showrooms of the Consolidated Gas Company.

Denver Electrical Show.

The first annual electrical show of the Colorado Electric Club was opened Monday evening, Oct. 10, and will continue during the present week. Capt. W. H. Green, the oldest pioneer of Colorado, pressed a button at 7:30 p. m., thereby closing the various electrical circuits producing spectacular effects. Simultaneously four tons of red fire were lighted on the streets and on the roofs of large business buildings in the city, cannons were fired, bombs exploded and all factory and locomotive steam whistles in the city shrieked. It is estimated that 25,000 visitors will be in the city during the exposition. Among the special trains will be one from Salt Lake City. The streets have been illuminated with portière effects, and some 25,000 additional street lamps have been installed for the occasion, aside from the exterior lamps in the vicinity of the auditorium where the electrical show is held.

Ten thousand incandescent lamps are used for the lighting of the interior. Among the lighting features is a sunrise effect showing a mountain scene characteristic of the Rocky Mountain region, with a running stream. The interior is darkened while the picture is shown in order to bring out the full effect of the rising sun, which measures about 8 ft. in diameter and is studded with 2500 lamps. By means of clockwork the rising sun is given a uniform movement, and the effect of moving water is produced by a number of flashers.

At the opening the Denver Gas & Electric Company's new building was lighted for the first time, 12,000 lamps on the façades forming a handsome decorative design. The booth at the show of the Denver Gas & Electric Company is in the form of an electric home equipped with electrical conveniences. In the kitchen are the various electrical heating and cooking devices, and electrical appliances designed for the general comfort of the home are distributed among the various rooms, all of which are lighted according to the latest illuminating engineering practice. The booth of the telephone company contains the old switchboard used by that company in 1878, alongside of which is a portion of a modern switchboard. The basement is devoted to spectacular displays, including high-voltage demonstrations. Denver boys have on exhibition there a number of wireless outfits of their own construction, which have been entered in competition for a money prize offered.

New York Electrical Show.

New York's fourth annual electrical show was opened to the public on Monday afternoon with an electric luncheon given in the restaurant of Madison Square Garden to the representatives of the metropolitan press by the New York Edison Company. Speeches fitting to the occasion were made by Mr. J. W. Lieb, Jr., of the New York Edison Company, and ex-Secretary of the Treasury G. B. Cortelyou, president of the Consolidated Gas Company, after which the company adjourned to the arena to view the exhibits.

This year's exposition has all the salient features of its forerunners, with much added material to interest the engineer, user of electrical energy, and the general visitor. There is a large display of electric vehicles and an interminable amount of electrical aids to the housekeeper, such as vacuum cleaners, electric heating and cooking apparatus, pumps, buffers, ozonizers, art glass shades, portables, lamps without number, and all sorts of little things for the home. The electrical laundry is shown with all its appurtenances, and flaming arcs pile on their rays where the tungstens give them a chance. The large manufacturers of electrical apparatus fill in the gap with specimens of motors and heavier apparatus, so that the show is not unbalanced.

The illumination and decorations in Madison Square Garden for the show beggar description, and betoken excellent taste and skill on the part of the management and the decorator, Mr. M. A. Singer, who was also responsible for previous creations in the Garden and at N. E. L. A. exhibits. The bleak walls and girdered roof of the arena are hidden from view behind pale-green and white bunting draped over the galleries above the first, which is given over to the electric light companies of the city. Fig. 1 herewith gives a general view of the show looking toward the booths of the New York Edison Company, which occupy the entire west half of the first gallery. This view shows the lighting arrangements. Over the center aisle of the arena are suspended three immense crystal chandeliers holding 548 25-watt, plain-bulb tungstens and 448 40-watt frosted-bulb tungstens. The twenty-eight smaller chandeliers suspended from the roof and encircling the arena are octagonal in shape running to a point at the top and fitted with mirrors and crystal chains. These hold 2940 25-watt, plain-bulb tungstens. Around the sides and balconies and under the signs are 1619 25-watt tungstens in Alba shades; the posts around the balcony holding sixty-four 250-watt tungstens in heavy glass globes and the small chandeliers over the central-station booths holding 252 25-watt clear-bulb tungstens in addition. On top of the posts holding the signs on the arena floor are thirty-four 40-watt tungstens in art glass shades and 306 25-watt lamps arranged in circles below the tulip globes. At the main entrance is an arch 30 ft. long and 24 ft. wide, the walls of which are fitted with mirrors and the ceiling of which is made up of 480 mirrors and studded with 250 lamps, giving a very dazzling effect. The exhibitors' booths are of Dutch Colonial design and the withdrawal of the electric light companies to the balcony has given more room on the main floor, which is distributed among the booths and passages to advantage. The combination of the white light from the tungstens, the pale-green and white decorations and the arrangement of the booths serve to accentuate the huge proportions of Madison Square Garden in a manner seldom, if ever before, attained.

Four electric light companies are represented at the show. Facing the entrance on the main floor is the booth of the Public Service Electric Company of New Jersey, where are shown all kinds of household electric appliances, including a display of high-grade portable and standard lamps. A feature of the display is the practical demonstration of the various kinds of electric cooking apparatus and small motor appliances. The booth is arranged to interest the user of domestic appliances and all things electrical which are conducive to the comfort of the home are shown.

The New York Edison Company does not exhibit any apparatus and devotes its space to reception rooms, etc.; facilities being provided for telephoning and writing, the negotiation of contracts, the distribution of advertising literature and for personal meetings between the public and the company's representatives. The walls are hidden by a very interesting and imposing array of photographs of lighting and other installations made by the company. When desired, visitors are escorted to the various exhibits on the floor below for the purpose of explaining the more important features and for the exploitation of the sale and use of the apparatus shown. A portion of the company's space on the north side of the Garden is given over to Prof. Ovington for experiments and demonstrations in high-frequency currents. At the rear end of the Garden is a wax figure of the Edison man, familiar to all New Yorkers, throwing red, white and blue lights from one hand to the other.

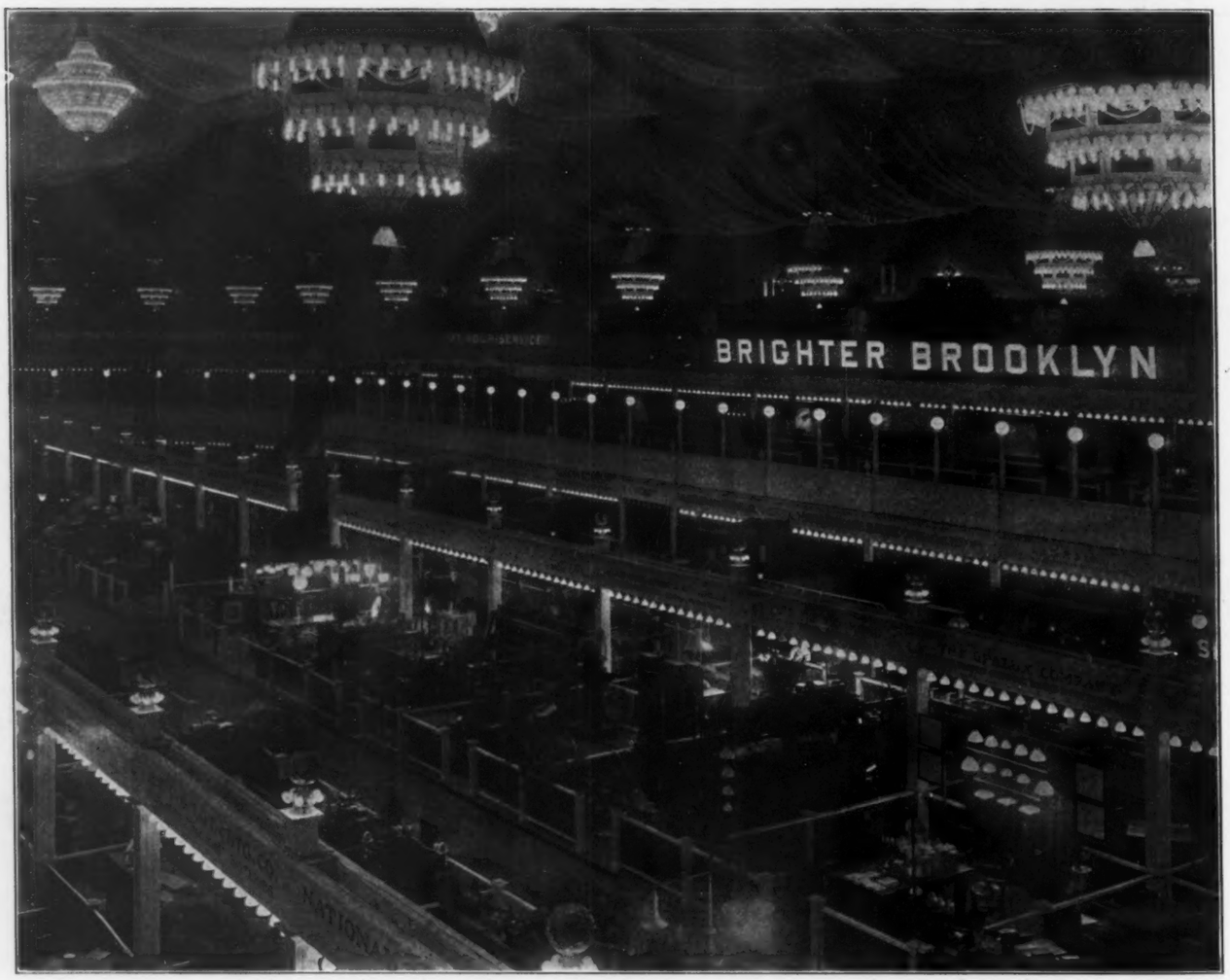


Fig. 1—General View of Madison Square Garden During Electrical Show.

The Edison Electric Illuminating Company of Brooklyn, with its "Brighter Brooklyn" slogan and its now famous "Belighted" illuminative cartoon of one of the shining lights of the universe, never fails to attract attention to its booths. The exhibit this year, which occupies the north side of the Garden balcony, portrays in picture and by representation some of the principal divisions into which the varied activities of the Brooklyn Edison company's business naturally falls. The display is divided into four sections. The first section indicates some of the many applications and advantages of electric motors in the industrial work of the community. Meters, test instruments and a complete motor installation are also shown in this section. The next section shows the service methods and appliances of the company. Various forms of line instruments, types of meter and typical installations are here exhibited. Forms of contract available to the public are pictorially represented and explained and general information as to cost of service, equipment, wiring, etc., is given. The third section is devoted to electric sign, outline and window displays. Pictures thrown on the screen from a lantern back of the booth illustrate the best and most attractive types of this kind of lighting, and apparatus showing methods of regulation and control is exhibited. In section four are shown in vivid fashion many modern applications of electricity to the home. Motion pictures show household work being performed by electricity and indicate how this method eliminates all the household drudgery. At the east end of the exhibit is a spacious reception room.

The United Electric Light & Power Company, of New York City, features modern window lighting installations, supplementing the exhibit by advertising matter pointing out the advantages to be derived from properly illuminated windows and giving several hints on the best methods to employ in this work. The company has had erected five store fronts, covering a total floor space of 100 ft., which are exact reproductions of the windows of four of the best merchants on the company's lines, who display their wares and merchandise in the respective windows. The exhibits portray four different window lighting schemes and the effects actually realized in

practice from them. In one of the windows, that of a New York department store, the display of electric lamps and apparatus represents over $9,000. The rest of the space on the south balcony is occupied as a sales office with a reception room at the end of the aisle. In the sales office regular business

Fig. 2—United Electric Light & Power Company's Exhibit.

is transacted. A list of exhibitors with the locations of the booths is distributed at the booth, and every convenience is offered visitors.

The general exhibits are described elsewhere in these pages. The show will remain open until Oct. 20. On Friday evening the New York Edison Company will entertain the electrical

Fig. 3—Brooklyn Edison Exhibit.

contractors in the concert hall, and on Oct. 18 the first annual convention of the Electric Vehicle Association of America will be held. After the morning session an electric luncheon will be served and the Edison company will give a smoker to the delegates in the evening.

Massachusetts Commission News.

A hearing was held by the joint board on metropolitan improvements at Boston on Oct. 6 upon the proposed tunnel between the North and South Stations. The board is composed of the Massachusetts Railroad, Boston Transit, Harbor and Land, and Metropolitan Park Commissions. Chairman George G. Crocker presided. Mr. W. Rodman Peabody, Boston, appeared on behalf of the Boston Chamber of Commerce, which believes that the tunnel should be built by the New York, New Haven & Hartford Railroad Company and not by the City of Boston; also that it should be held by the railroad on terms which would give a fair compensation to the city for its use, with the ultimate right of the city to purchase the tunnel if deemed desirable. The tunnel would be operated by electricity, and according to the plans already outlined by the New Haven company would afford large economies in the operation of suburban service by the elimination of much of the present shuttle-train movements which are a handicap to the traffic at the great terminal stations. It would also afford better distribution of passengers than is now possible with the terminals practically isolated from each other. A feature of the ultimate scheme would be the electrification of much of the nearer suburban service outside Boston on the north, south and west. Mr. W. B. Lawrence, of Medford, Mass., appeared in opposition, on the ground that the estimated cost of $16,000,000 for a length of 6000 ft. was excessive. The board continued the hearing for two weeks to receive further evidence.

The Boston Elevated Railway Company has filed plans with the Massachusetts Railroad Commission showing proposed changes in the elevated terminal station at Sullivan Square, Charleston, in connection with the extension of the elevated lines to Everett and Malden. The new arrangement of the Sullivan Square station provides for the abolition of surface-car stub tracks on the west side of the main waiting-room and transfer shed, the building of a new loading platform for elevated trains and surface cars, and the erection of a foot bridge to facilitate the separation of inward from outward bound traffic. The tracks will be arranged so that the elevated trains running out of Boston can be turned back to the city proper at Sullivan Square or else continued to Malden and Everett. Trains from Malden to Boston are to pass around the outside of the terminal to the special loading platform, instead of entering the train shed. The board will give a hearing upon the plans.

New Jersey Commission News.

The Board of Public Utility Commissioners for the State of New Jersey has refused to issue a certificate of approval of a proposed merger and consolidation of the East Greenwich Gas Company and the New Jersey Gas Company. The board directs attention to Chapter 331, P. L., 1906, which requires that a company subject to its provisions shall not "hereafter issue, sell and deliver any of its capital stock except for cash of a like or greater amount than the par value of the stock issued therefor, or for property of at least the actual cash value of the amount of stock at par value issued in payment therefor." In its finding the board states, "In the papers filed with the board there is nothing to show that the provisions of this statute were observed in the issuance, sale and delivery of the capital stock and bonds of the East Greenwich Gas Company."

The board has also refused to approve the proposed increase of capital stock from $300,000 to $1,600,000 of the Newark & Bloomfield Railroad Company (part of the Delaware, Lackawanna & Western Railroad system). In filing this opinion the board finds that "there is nothing in the papers submitted to indicate that action of any kind has been taken by the board of directors of the company with respect to issuance, sale and delivery of 29,923 shares remaining unissued or any part thereof. Although the joint affidavit of the president and treasurer of the company avers 'that new capital stock to the amount of $1,496,150 is to be issued, sold and delivered for cash, at the par value thereof,' there is nothing in the papers to show that this statement is based upon action taken either by the stockholders or board of directors of the company."

Wisconsin Commission News.

The case of the National Travelers' Association of America against certain Milwaukee hotels, the prime contention of which related to the extra charge of 5 cents exacted by hotel proprietors for outgoing city calls from rooms, has been dismissed by the commission for want of jurisdiction. The petitioner is a voluntary organization whose general purpose is to promote the welfare of its members. Only mercantile, agricultural and manufacturing societies, bodies politic and municipal corporations can, acting individually, invoke the jurisdiction of the commission. The commission, however, contemplating another petition upon the same subject, deemed it advisable to foreshadow the probable conclusion that would be reached in event the matter should again be submitted for consideration.

The petitioners contended that in view of the fact that the telephone company charges but 5 cents for each call at its public pay station, it may not either directly or indirectly establish or caused to be established any pay station where it may charge in excess of 5 cents for a similar service. This view the commission also seemed inclined to take.

An examination of the contracts between the telephone company and the various hotel proprietors involved disclosed the fact that the company agreed to furnish one unlimited service telephone free of charge as an additional consideration to the commission paid to the hotel for collecting tolls. The commission considers that such an arrangement operates unjustly between hotel subscribers. Furthermore, the statute requires every public utility to file with the commission schedules of all rates, tolls and charges which it has established, and also as a part of such schedules "all rules and regulations that in any manner affect the rates charged or to be charged for any service." Consequently, the above provisions of the contract are in violation of the statute, for the published schedule makes no such provision. In commenting upon this point the commission says "the exchanging of services in the manner provided in the contracts is indefensible from any point of view. Services, whether rendered by or to the company, should be estimated upon a definite monetary basis, and not otherwise. By so doing all unjust discrimination will be avoided." Furthermore, "as we view the situation, the private system within the hotels is but an extension of the telephone company's system as far as the former is used to furnish telephone service to the public in connection with the latter. In such connection the stations in the rooms of the hotels are as much pay stations as those located in the company's booth in the hotel lobbies." In conclusion the commission says "the duty of the telephone company under the circumstances is either to make such arrangement with the hotels that the charge from the stations located in the rooms of the hotels shall be no greater than those exacted at other public pay stations of the telephone company, or to discontinue the rendering of joint service in connection with such hotel systems."

The commission has authorized the Menominee Gas Company to issue bonds to the extent of $100,000 par value, in denominations of $500 each and to bear interest at the rate of 5 per cent per annum. The bonds are to be issued and sold for the purpose of supplying the company with funds for the payment of an outstanding indebtedness of $70,000, incurred in the purchase of the gas plant of the Menominee Light & Fuel Company; for the purpose of supplying funds for working capital, and for making extensions and additions to the property. The bonds are to be issued for money only and for not less than 75 per cent of the par value.

The Clifton Light & Power Company, of Hudson, Wis., has been authorized to issue stock and bonds as follows:

(1) Seven hundred and fifty shares of common stock of the par value of $100 each, said stock to be issued for money only and for not less than par value.

(2) Twenty-five thousand dollars par value of bonds, dated Oct. 1, 1910, bearing interest at the rate of 6 per cent per annum; ten bonds to be of the denomination of $500 each and to mature in five years from date; twenty bonds to be of the denomination of $1,000 each, two to mature in six years and the remainder in two years.

(3) The proceeds of the sale of said stock and bonds shall be used for the purpose of purchasing real estate and flowage rights, pole line and right-of-way therefor, upon which is to be constructed a dam, power site and other structures convenient in the carrying on of a hydroelectric power plant and the distribution and sale of electric current produced thereby. Also, for the purchase of an existing pole line running from the site of the proposed power plant to the village of Prescott, in Pierce County, Wis., and for the purchase of the electric light and power plant located in the village of Prescott. The funds are also to be used in the purchase of the necessary machinery for the operation of the main power plant to be located in the town of Clifton, Pierce County, Wis., and also for the construction of a transmission line from such power plant to the city limits of the City of Hastings, Minn., and for the construction of a substation at that point. The bonds authorized shall be issued for not less than 75 per cent of their par value.

New York Commission News.

The Public Service Commission, Second District, will during the present week hold public hearings as follows:

At Albany the commission will hear the complaint of the Civic League of Albany as to prices charged by the Municipal Gas Company for electricity. The complaint alleges excessive charges for light and power for window lighting, for sign lighting, power meter service and elevator service. Business men on North Pearl and State Streets, and Maiden Lane and Broadway, are the principal complainants.

The commission will also hear at Albany the petition of the Westchester Lighting Company for permission to issue $1,433,000 in bonds, and the application of said company for a modification of an order of this commission, and the petition of the Northern Power Company for permission to exercise franchises for supplying electric current in the village of Richville, St. Lawrence County.

AMERICAN ELECTRICAL ENGINEERS—XVI.

A. B. Field.

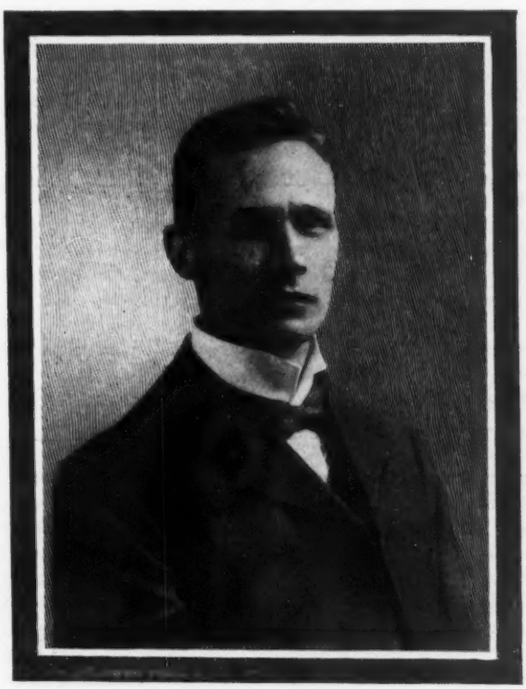
Allan Bertram Field was born at Barnet, near London, in 1875. He received his primary education at Highgate Grammar School, London, his technical education at Finsbury Technical College, London, and later, his scientific training at St. John's College, Cambridge.

In conformity with traditional English ideas as to the training required by an engineer, he followed his technical training by a period of service in mechanical engineering shops as machinist and fitter in order to become practically acquainted with shop work. In 1900 he joined the engineering staff of the British Thomson-Houston Company and was engaged on preliminary work in connection with some of the London "tube" railways, now operating, and other power plants. He was later transferred to the American works of the General Electric Company, at Schenectady, and engaged in testing work and transformer design.

In 1904 Mr. Field made the acquaintance of Mr. B. A. Behrend, to a study of whose work and to whose generous assistance so many engineers have owed their successful advancement, and who at that time was chief engineer of The Bullock Electric Manufacturing Company and chief electrical engineer of the Allis-Chalmers Company. Shortly afterward he became the chief assistant on alternating-current work to Mr. Behrend, and had charge of the design of alternators, synchronous motors and induction motors, which post he held through a period of considerable commercial activity and until the close of 1908. During this time a number of interesting

problems presented themselves for solution in connection with comparatively new applications of alternating-current apparatus, the further development of turbo-generators, etc. Large alternators for direct coupling to gas engines began to take a more important place in the industrial world, and the application of this class of apparatus in steel-mill work, on a scale hitherto unattempted, called for a considerable amount of study and experiment in which Mr. Field co-operated with Mr. Behrend. As an instance of large gas-engine operated power plants installed by the Allis-Chalmers Company may be mentioned that at the Gary works of the U. S. Steel Corporation, where alternators aggregating 40,000 kva rated output are operated together. Early in 1909 Mr. Field accepted an invitation to join the Westinghouse Electric & Manufacturing Company in its engineering department and has since been engaged on electrical and mechanical designing work, principally in connection with new large generators.

Several patents have been granted to Mr. Field relating to constructions of electrical machinery in commercial use. He is the author of an important investigation of the eddy-current losses occurring in deep conductors carrying alternating current, some of the results of which were published in a paper presented to the American Institute of Electrical Engineers at its annual convention in 1905 and in an article in these columns in the issue of Sept. 29, 1906. The conclusions originally arrived at have since been amply confirmed experimentally, both by direct laboratory measurements and by evidence from numerous commercial tests, and the methods advocated for minimizing these losses are in general commercial use in large generators. For an original communication, entitled "The Dissymmetry of a Three-Phase System," and dealing with some features of two-to-three-phase transformation, a premium was awarded to him by the Institution of Electrical Engineers of Great Britain in 1905.



A. B. Field.

Mr. Field is a member of the American Institute of Electrical Engineers, member of the (British) Institution of Electrical Engineers and of other engineering and scientific societies. He holds the M.A. degree of the University of Cambridge (Mathematical Tripos) and the Honors B.Sc. degree of the University of London.

CURRENT NEWS AND NOTES.

Telephone Activity in Chicago.—For the month of August the Chicago Telephone Company reports a net gain of 2370 stations. For the first eight months of this year the net gain has been 23,332. The total number of telephone stations (city and suburban) connected to the exchanges of this company on Sept. 1 was 285,691, a gain in one year of 37,022, or 14.9 per cent.

One Municipal Plant for two Cities.—A municipal electric light plant to serve San Bernardino and Redlands, Cal., is projected by the City Councils of both cities. It is planned to erect a large generating station between the two cities. The trustees of Redlands have appointed a committee to confer with the city officials of San Bernardino on the subject. This committee will also endeavor to secure from the Southern California Edison Company a price on that company's distributing system in Redlands, and estimates on the supplying of electricity at wholesale rates.

Wireless Interference.—Newspaper dispatches relate that a "wireless" operator was charged in the City Court of Buffalo on Sept. 28 with having wilfully prevented the transmission of a wireless message from the steamer *Western States* on Sept 21 when disabled in Lake Erie off Long Point. The operator on the steamer tried for several hours to ask assistance both from Buffalo and from Erie, but it is alleged that an opposition company, for which the defendant worked, interfered and "smothered" the wireless signals from the boat. It is said that the maximum penalty for this offense in New York State is four years' imprisonment. The case was adjourned.

A Village Electric Light Situation.—A newspaper in the West prints the following survey of the electric light situation in its town, following a visit there of an electrical man: "The object of his visit to Oak Grove, as he informed us, was to agitate the electric light question to light our town, the power to be furnished by this railways electric plant which perhaps was legitimate and all right, but a company had just been organized for the same purpose, composed of some of our best citizens, and the only reason why it is not in operation now, was the question of power, some of the members of the company were in favor of water power and others favored a solar engine, the objection to water power was because we have no fall of water, and the objection to a solar engine was that it cannot be operated only when the sun shines and that is the way the matter stands at present."

Canadian Business-Getting Methods.—It is estimated that the United States is now selling to Canadians $750,000 worth of products every business day in the year. This trade has attracted many American manufacturers, who have set up branch works in the Dominion with investments in plants and working capital that now total about $275,000,000. In the Canadian West cities and towns are bidding for American enterprises by the establishment of municipal leagues and bureaus through which advertising campaigns are being vigorously pursued. Winnipeg, Manitoba, is an example of what can be accomplished by united efforts of this nature. Four years ago that city formed an official institution composed of representatives of several business bodies, headed by the City Council, Board of Trade, bankers' association, etc., entitled the Winnipeg Development and Industrial Bureau. It now has representatives of sixteen business bodies on its board of directors, having 8700 affiliated members, 425 of whom are business firms who contribute to its financial requirements. Memorials are being prepared for presentation before the next session of the Dominion House opposing any general reduction in the tariff, all of which forms a part of the argument for the establishment of branches of United States industries in Canada.

Iron and Steel Electrical Engineers.—The next meeting of the Association of Iron and Steel Electrical Engineers will be held at Hotel Schenley, Pittsburgh, Pa., on Oct. 17, 18, 19 and 20. The secretary is Mr. G. H. Winslow, 509 Perry-Payne Building, Cleveland, Ohio.

Electricity from Wind Power.—It is reported that one of the largest windmills in the world has just been completed at Willesden, England, which will be used to generate electricity for supplying energy for operating crushing machinery, pumps etc. The energy will also be employed for operating lamps and for various domestic purposes.

Proposed Electric Club in Butte, Mont.—Electrical men in Butte, Mont., are considering the possibility of forming an electric club, something after the plan of the successful organization bearing that name in Chicago. Mr. L. C. LaMont, of the Butte office of the Westinghouse Electric & Manufacturing Company, is one of the gentlemen interested.

Annual Meeting of Empire State Gas & Electric Association.—No formal program of papers was prepared for the annual meeting of the Empire State Gas & Electric Association at the United Engineering Societies Building, New York, on Oct. 5. Morning and afternoon sessions were held and lunch was served at the Engineers' Club.

Pittsburgh Electric Club.—At a meeting of the Pittsburgh Electric Booster Club, held at the Duquesne Hotel on Sept. 30, Mr. Morris Knowles, a member of the Pittsburgh Civic Commission, as the principal speaker, pointed out wherein the club as a whole and its members individually could be of assistance in promoting the welfare of the city.

Wireless Telegraphy in Russia and Siberia.—The Russian government is reported to have under contemplation the establishment of an extensive system of wireless-telegraph stations across Siberia, and also probably a network of communications over Russia proper. Tests and experiments are being made with several different systems, preliminary to determining which one will be used on a large scale.

Indiana Telephone & Railway Valuations.—The total valuation of telephone lines and property in the state of Indiana, as fixed by the state board of tax commissioners on appeal, is $11,146,832. This is an increase over the valuation in 1909 of $1,050,558. The valuation of the electric railways in Indiana is placed by the commissioners at $22,376,238, an increase over the valuation in 1909 of $840,197.

Motor Manufacturers' Association.—The annual meeting of the American Association of Electric Motor Manufacturers will be held in the Blackstone Hotel, Chicago, on Nov. 14 to 16. There will be a number of committee reports, and during the convention the annual dinner of the association will be held. Mr. H. H. Smith, of the Chicago office of the Diehl Manufacturing Company, is in charge of the local arrangements.

Instruction in Wireless Telegraphy.—Announcement has been made that a theoretical and practical course in wireless telegraphy will form part of the physics course of the McKinley Manual Training School in Washington, D. C. A complete equipment for practical work will be erected at the school, the object being to train young men to become wireless telegraph operators. A course in wireless telegraphy is being offered at the Baltimore Polytechnic Institute. A complete standard wireless station will be installed in the school building, which will soon be completed, on North Avenue.

Steinmetz Lecture in Chicago.—Dr. C. P. Steinmetz, of Schenectady, will deliver an address on the "Industrial Importance of Electrostatics and Electric Impulse Forces" before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the electrical section of the Western Society of Engineers in Fullerton Hall, Art Institute, Chicago, on the evening of Oct. 19. This is an interesting and rather unusual subject, and there is no doubt that Dr. Steinmetz will be greeted by a large audience, as in former years when he has opened the season's program of joint meetings in Chicago at the same place.

Grand Canyon Power Dream.—According to a report from Los Angeles there is a project afoot to build a dam 700 ft. high that will store the water of the Colorado River in the Grand Canyon and develop 1,500,000 hp. Mr. Irving E. Bush, a mining engineer of Rialto, Cal., and Mr. Thomas Fellows, a Los Angeles architect and engineer, are stated to be in charge of the project. Their plans call for the expenditure of $2,000,000. The site for the proposed dam is just across the California line in Arizona, within 360 miles of Los Angeles and close to the Nevada border. It is claimed by the promoters that this electric power would lead to the mining of lower grade ores that cannot now be worked at a profit because of the high cost of fuel and power.

Driver Stepped on Match; Gasoline Auto Truck Exploded.—The gasoline tank of a large motor truck, valued at $1,000, the property of the Reid Ice Cream Company, exploded with a loud roar in front of 846 Atlantic Avenue, Brooklyn, Oct. 5, compelling the driver to jump for his life and resulting in the total destruction of the vehicle by fire. The cause of the explosion is not known. Henry Tiedmann, the driver, says that in some way a match had fallen on the foot rest and was ignited by his shoe. The gas from the 10-gal. gasoline tank flamed up and instantly there followed an explosion that nearly overturned the truck. Tiedmann protected his face with his hands and sprang from his seat. He struck the ground heavily and was severely bruised, but escaped the flames.

Wireless from Aeroplane.—It is reported that satisfactory success was obtained from experiments carried out by Mr. Robert Loraine in maintaining wireless communication between an aeroplane in flight and a land station in London. The portable wireless apparatus weighed only 14 lb. The transmitter was attached to the passenger seat, and the aerial wires were stretched along the length and breadth of the biplane. The key for sending the messages was fixed at the airman's right hand. The detector used was of the Marconi electromagnetic design. Communications were maintained with the biplane up to a distance of about one quarter of a mile. The information thus obtained will be utilized in making improvements for covering longer distances.

Hydroelectric Power in Turkey.—The streams and rivers of Turkey present a wealth of hydroelectric power according to travelers who have penetrated into the interior of that country, but until two years ago even the importation of all electrical apparatus was strictly prohibited. An awakening to the use of this power is now due, it is said, and European electrical manufacturers are prepared for the boom which seems certain, having agencies already established in the principal cities of the Sultan's domain. A recent report from Consul-General Ernest L. Harris, at Smyrna, calls attention to a remarkable lake, fifteen miles across, at the summit of a mountain 2500 ft. above the surrounding plain. This lake is estimated to discharge 3000 cu. ft. of water per second during the winter season, and half this amount during the summer and autumn months. On a conservative estimate, taking the minimum figures for flow and available fall, this lake overflow should develop at least 300,000 hp continuously. The surrounding country is in distressing need of irrigation and transportation facilities, both of which could be supplied on an ample scale by the water-power development of the stream. The mountain is also said to be a veritable mine of minerals.

New York-Denver Long-Distance Telephony.—At the beginning of next year long-distance telephone communication will be established between New York and Denver, a distance of 2200 miles. Phantom-loaded overhead circuits will connect the two cities.

German-American Patent Reform.—Reports are current that German manufacturers are desirous of having the existing patent convention between the United States and Germany amended on the lines of the existing British patent treaty, so as to require Americans taking out German patents to manufacture the patented articles in Germany.

London-Paris Telephone Line.—The telephone connection of Great Britain with the mainland of the Continent has been established, and communication is now rendered easy from London to Paris and to north French and Belgian cities. The lines are reported to be working distinctly, and the authorities hope to establish regular service between London and Marseilles and German cities.

Increase in Rubber Supply.—An extensive source of supply of crude rubber, said to be equal in quality to Para, has been discovered in the palo amarillo tree which is found over a considerable territory near Guanajuato, Mexico. A plant for the manufacture of crude rubber from the sap of the trees has been established at Empalme de Gonzales, and five others will soon be placed in operation in the States of Guanajuato and Michocan.

Postponement of Russian Electrical Exposition.—The Technical Society of St. Petersburg has postponed until April 28, 1911, which is the seventy-fifth anniversary of steam locomotion in Russia, its exhibition of electric railway and power plant apparatus, which was to have been opened Aug. 28. The exhibition will be divided into several sections: The electrification of steam railroads; main-line electrification; local branch-line electrification; operation of street railways, and the use of water-power.

Telephones in New York City.—In a paper presented at the recent Paris International Telegraph and Telephone Conference Mr. J. J. Carty stated that in 1900 there were 51,398 telephone stations in Greater New York served from forty-three central offices. In 1910 the plans provide for 376,000 stations served from fifty-two central offices, with an estimated population of 4,800,000. In 1930 the plans provide for 2,142,000 stations to be served from 109 central offices, with an estimated population of 8,800,000.

Examination for U. S. Hydroelectric Engineer.—The United States Civil Service Commission announces an examination on Nov. 9 and 10 to secure eligibles from which to fill two vacancies in the position of hydroelectric engineer at San Francisco, at $2,100 and $2,400 per annum, and other vacancies as they may occur at salaries ranging from $2,100 to $3,000 per annum. Applications should be made to the United States Civil Service Commission at Washington or at one of its offices throughout the country.

Commonwealth Edison Branch of N. E. L. A.—At the first of the fall meetings of the Commonwealth Edison Branch of the National Electric Light Association on Sept. 29 Mr. B. E. Roffee, of the construction department, read a paper on "The Application of Electric Motors to Group and Individual Drive for Different Kinds of Industrial Power Purposes." Mr. N. A. Rollins, of the engineering department, followed with a paper on "Building Construction and Alterations Exclusive of Generating Stations," referring to the practice of the Commonwealth Edison Company. Both papers were illustrated by lantern-slide pictures. Some of the first motors placed in service were shown, and the gradual development of motors, up to the present day, was illustrated. The methods of the engineering department in erecting new buildings and making changes were explained. Chairman J. C. Manley presided and addressed the meeting on the opportunities of the organization.

Electrical Illumination of Ottawa Streets.—The Ottawa Electric Company is making a proposition to the merchants of Ottawa, Ont., for the illumination of certain streets. It is proposed to install on Sparks Street, for a distance of about three blocks from Sapper's bridge, thirty-six standard steel posts, each supporting five 50-cp tungsten lamps. The maximum height of the standard is 15.5 ft. and the base 24 in. They will be placed on both sides of the street at alternate distances of 50 ft. apart. The lamps will be kept lighted from sundown till midnight, and the cost is to be divided among the ground-floor tenants of the premises at the rate of 10 cents per month per foot frontage. Thus a store with 33-ft. frontage will be charged $3.33 per month, or 74 cents per week. The lighting company will furnish the standards, lamps and all equipment, together with the energy. The scheme is said to be meeting with favor among the merchants, most of them having already signed the proposed contract with the company.

Preparations for Illinois Convention.—The annual convention of the Illinois State Electrical Association will be held in the Safety Building, Rock Island, Ill., on Oct. 25, 26 and 27. This building contains the offices of the People's Power Company, and in connection with the convention there will be a display of electrical exhibits in charge of the Illinois Electrical Exhibitors' Association, of which Mr. W. R. Pinckard, Westinghouse Electric & Manufacturing Company, Chicago, is president, and Mr. W. S. Taussig, General Electric Company, Chicago, is secretary. The area available has been divided into about twenty exhibit spaces. The People's Power Company will issue an invitation to the citizens of Rock Island, Ill., Moline, Ill., and Davenport, Ia., to attend, free of charge, the electrical display which the exhibits will afford. Thus there will be a much larger attendance at the exhibition than that afforded by the number attracted by the convention itself. The entertainment features will include a smoker on the evening of Oct. 25 and a theater party the next evening.

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Oct. 5 Mr. George H. Porter, chairman of the entertainment committee, reported that the total expenses of the August outing of the club at Ravinia Park were $373.41. Receipts from all sources amounted to $393, leaving a balance of $19.59. Mr. James H. Delany reported from the rallying committee, and Mr. Robert S. Mitten gave some account of the plans for increasing club membership. Mr. W. R. Pinckard called attention to the annual convention of the Illinois State Electrical Association, to be held in Rock Island on Oct. 25 to 27, and explained the preparations under way for the exhibits and entertainment features. The speaker of the day was Mr. Gale Blocki, of the Chicago bar, whose subject was "The How and Why of a Contract." Mr. Blocki, in the course of his talk, remarked that the formality that formerly surrounded the making of contracts is gradually disappearing, common sense taking its place. In drawing a contract, it is important to be sure that it is as simply worded as possible, while still covering all contingencies. A contract executed on Sunday is good in Illinois. Business men should be careful in fixing the time limit of a contract, and should then live up to the time limit imposed. By far the greater proportion of contracts are verbal and implied, not written, and every man should endeavor to carry out faithfully the obligations of the unwritten contracts into which he enters. There was no discussion but Mr. C. Walter Jones, of Newark, Ohio, general manager of the Holophane Company, was introduced and made a few remarks.

Philadelphia Meeting of the I. E. S.—A meeting of the Philadelphia Section of the Illuminating Engineering Society will be held on Oct. 21, the speaker of the evening being Mr. Francis H. Gilpin.

Public Service Laws for Japan.—The Imperial Japanese Parliament is investigating the New York Public Service Commission laws with a view to adopting similar laws for Japan.

Water-Powers in Asia Minor.—United States Consul-General Ernest L. Harris, at Smyrna, states that Asia Minor abounds in opportunities for the installation of hydroelectric equipments, although no attempts have as yet been made to utilize the numerous water-powers of the country.

Large Generators in Mexico.—Two of the largest hydroelectric generator sets ever built are now being erected in the Necaxa station of the Mexican Light & Power Company. Each generator is capable of carrying a maximum load of 15,000 kw. It is a three-phase machine designed for 4400 volts, 50 cycles and will be driven at 300 r.p.m.

Value of Electric Property in North Carolina.—The assessments of electric light and gas companies, and of street-railway companies, in North Carolina for 1910, as compared with 1909, show the following: Electric light and gas companies from $1,588,000 to $2,220,000, an increase of $632,000; street railways from $2,116,000 to $2,035,000, an increase in assessment of $80,000.

Wireless and the Electric Vehicle.—Reports from Los Angeles state that Mayor Alexander has received a wireless telegraph message sent from the top of Lookout Mountain by means of a portable set receiving energy from the storage battery of an electric vehicle which had conveyed the operator and witnesses to the top of the mountain for the purpose of experimenting with the equipment.

Chicago Section, I. E. S.—The first fall meeting of the Chicago Section of the Illuminating Engineering Society is announced for 12:30 p. m. on Oct. 13 at the Great Northern Hotel. After luncheon Mr. Joseph Newman, Jr., of the International Harvester Company, is down for a paper on "Good Lighting from a Factory Viewpoint." A secretary for the section will be elected. It is announced that over 200 members have been added to the Chicago Section during the summer.

Brazilian Wireless Telegraph Station.—The Brazilian government has erected a wireless telegraph station on the beach at Amaralina, close to the village of Rio Vermelho. The new station is equipped with the Telefunken system and has a guaranteed range of 400 miles. The principal features of the station are as follows: Height of mast, 197 ft.; primary power 20 amp and 220 volts; speed of generator, 1500 r.p.m.; high-tension of transformer, 15,000 volts to 20,000 volts; number of jars (Leyden), 4; length of waves, 600 m, 1000 m and 1600 m (656.1 yd., 1093.6 yd. and 1749.7 yd.).

Electrical Industry in England.—The British Board of Trade returns state that the imports of electrical machinery into the United Kingdom in 1908 amounted to 6353 tons and in 1909 to 5461 tons, a reduction of over 16 per cent, while the exports for those years were 18,482 tons and 18,698 tons, showing an increase of about 1.1 per cent. The value of the imports of other electrical goods and apparatus increased from $6,318,810 in 1908 to $6,612,545 in 1909, while that of the exports rose from $9,715,520 to $11,153,995 in those years, equal to increases of 4.6 per cent and 14.7 per cent, respectively.

Norwegian Hydroelectric Undertaking.—At Bergen, Norway, electric generators which are now being driven by steam engines will be replaced with hydroelectric generators. The undertaking involves the blasting of a water tunnel which will exceed two miles in length, and which, it is expected, will take two and one-half years to complete. The new station is being erected at Samananger, to the east of Bergen, and will generate energy at 7500 volts, transformed to 40,000 volts for transmission to Bergen. It is anticipated that the undertaking will be finished during 1912, and that the cost will be about $1,000,000 for a 30,000-hp installation.

Serious Electric Railway Accident.—As the result of a head-on collision between two trains on the Illinois Traction system near Staunton, Ill., on Oct. 4, thirty-six lives were lost and nearly as many persons were injured. The wreck appears to have been due to the disregarding of train orders by one of the train crews. The financial loss to the company, including the payment of claims for the deaths and injuries, may amount to $500,000 or more. Among those killed were three officials of the Illinois Traction System—Mr. W. W. Street, superintendent of the St. Louis-Springfield division; Mr. John E. Barry, land commissioner, and Mr. D. E. Black, master mechanic.

Electrical Industry in Germany.—Statistics relating to the imports and exports of electrical material show that 371 tons of electric lighting apparatus were imported into that country last year, and that 7185 tons were exported, the imports being 3.3 per cent above and the exports 11 per cent below the figures for 1908. During 1909 69 tons of telegraph and telephone appliances were imported and 1601 tons were exported; in this case the imports were stationary, but the exports show an increase of 5.7 per cent as compared with 1908. Measuring instruments formed the third largest item; of these 95 tons were imported and 1223 tons exported, these figures being 19 per cent and 15 per cent above those for 1908.

Projected Electric Development in Peru.—According to an official decree a syndicate has been granted the right to develop power from the River Chancay, in Peru, and to build and operate an 80-mile electric railway between Ancon and Huacho, and supply electric energy to large farming estates in the neighborhood. Consul-General Robertson states that if the project materializes there should be an excellent opening for American rolling stock, which is already largely used in Peru on steam and electric roads, and for electric machinery, fixtures, etc., and for other articles entering into the construction of both the water-power plant and the road itself, as well as for machinery and equipment for the farming estates.

Western Society of Engineers.—At a meeting of the Western Society of Engineers of Chicago, on Oct. 5, a proposed revision of the constitution to meet the present needs of the society was presented. Among other things it is proposed that there shall be a new classification of members, including student members, with branches in engineering schools. An effort will be made also to weld the various sections of the society, of which the electrical section is one, more closely to the main body. The occasion was interesting as being the first meeting of the new hydraulic, sanitary and municipal section, Mr. John Ericson, city engineer, of Chicago, and chairman of that section, presiding. There was a general and rather desultory discussion of the address of Mr. B. E. Sunny, president of the Chicago Telephone Company, on "The Engineering of Chicago," delivered at the last annual dinner of the society, but not discussed at that time. Mr. Sunny was out of town, but he was represented by Mr. J. G. Wray, chief engineer of the Chicago Telephone Company, who abstracted his paper. Mr. Sunny suggested the appointment of a board of high-class consulting engineers to study such subjects as subways, water system, sewerage, railroad terminals, deep waterways and harbors. This proposal was discussed, but no definite conclusion was reached, several of the speakers being in favor of coordinating and systematizing the work of the present municipal engineers rather than appointing an outside independent board.

A LOW-HEAD HYDROELECTRIC PLANT.

Engineering and Economical Features of the Electric Generating Equipment at the University of Iowa.

By Arthur H. Ford.

THE hydroelectric plant of the University of Iowa furnishes an excellent example of a low-head installation operating with a load having a load-factor between that for a plant having a large motor load and one with a lighting load exclusively. The load closely approximates that of an office building, as most of the buildings are in use, with halls and some rooms lighted, until 10 o'clock at night and are supplied with electrically driven ventilating fans. The hospital, which is one of the university buildings, demands twenty-four-hour service, which fact is taken advantage of in supplying energy for the campus lighting. Previous to the installation of the present plant, energy was supplied by an 80-kw, direct-current, 110-volt, three-wire engine-driven set located at the heating plant, the hospital being lighted from the plant of the Iowa City Gas & Electric Company.

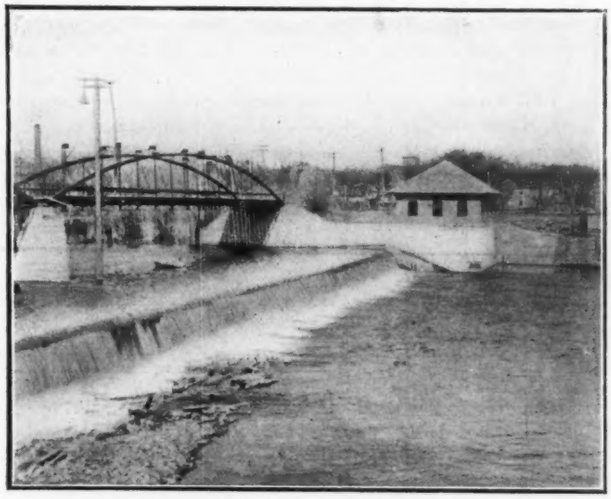


Fig. 1—Concrete Dam and Power House.

The water rights belonging to an abandoned grist mill located about a mile above the campus having been presented to the university for development, it was found, upon investigation, that there was a good site for a dam, which would allow of a slightly increased head being obtained at a point adjoining the campus. The head developed varies from 9 ft. to 1 ft., depending on the stage of the river. The extreme variation is due to the slight grade of the river below the power house, which causes the tail water to rise much faster than the head water during a flood. On this account the hydraulic equipment has been so designed that the plant is able to operate and supply a moderate amount of power when the head is as low as 3 ft. An investigation of the stream flow, as determined by readings taken at the government gaging station formerly located a few hundred feet above the site of the plant, showed that 200 kw could be counted on for eight months in the year and that floods great enough to reduce the output materially seldom occurred at the time of the yearly peak load.

Dam and Power House.—The concrete dam and power house foundation, shown in Fig. 1, have a combined length of 300 ft. and extend to rock foundation, 10 ft. below low water. There are six gates having a clear waterway of 40 sq. ft. each, three being provided for each wheelpit. Each wheelpit contains two 51-in. vertical-shaft turbines geared to a horizontal shaft running at 300 r.p.m. when the head on the wheels is more than 7 ft. This shaft is connected to the wheels and generator pulleys in such a manner that generator No. 1 may be driven by one, two or three wheels as desired and generator No. 2 may be driven by one or two wheels. In order to be able to run the generators at full speed when the head on the wheels is low each machine is provided with three pulleys of different sizes, which are changed as the head varies. One man can easily make the change by the use of the traveling crane. Two electrically controlled governors are provided, one for controlling the gates of each pair of wheels.

The electrical equipment consists of two 100-kva, two-phase, 2300-volt, 900-r.p.m., revolving-field generators with directly connected exciters, and a three-panel switchboard. The switchboard is unusually complete for a plant of this size, as it was designed for purposes of instruction as well as regular operation of the plant. Each of the two generator panels is equipped with two main ammeters, one voltmeter, one indicating wattmeter, one field-circuit ammeter, one watt-hour meter, one power-factor meter, one governor control switch, one compound rheostat, one field switch, two main line oil switches, one voltmeter receptacle and one synchronizer receptacle. The feeder panel is equipped with two double-throw oil switches and four static ground detectors, two for each feeder. Two sets of busbars are provided. On a swing bracket are mounted a frequency indicator and a synchronizer.

Fig. 2—Interior View of Power House, Showing Generator, Switchboard and One of the Changeable Pulleys.

Transmission Lines.—Two overhead transmission lines of No. 4 wire extend a distance of 2500 ft. from the generating station to the substation.

Substation.—The substation contains a motor-generator set consisting of a 50-kw, two-phase, 2300-volt synchronous motor

directly connected to two 22.5-kw, 125-volt direct-current generators. A shaft extension is provided for this set so that it can be driven from a 150-hp internal-combustion engine by means of a belt. This engine and the older three-wire, steam-driven set constitute a reserve plant for use when the hydraulic plant requires help.

The alternating-current section of the switchboard contains three feeder panels, each equipped with a double-throw oil switch, and a motor panel which is the duplicate of the generator panels at the power station. In addition there are a synchronizer and two recording voltmeters, one for each set of busbars. The two sets of busbars are the continuation of the transmission lines, there being no switches at this end of the line. The starting device for the synchronous motor consists of a pair of series reactors with a short-circuiting switch.

The direct-current section of the switchboard consists of one generator panel with an ammeter, a voltmeter, a three-pole knife switch and a field rheostat for each generator and a three-wire watt-hour meter, and one feeder panel with five three-pole knife switches and a ground detector.

Distribution Circuits.—Conduits extend underground from the substation to the various buildings, and in these are 2300-volt, paper-insulated cables terminating in transformer chambers in the various buildings. The direct-current feeders which were in place when the new plant was constructed were run in the steam-pipe tunnels and in conduit to places where the tunnels did not reach, while the new direct-current feeders have been run in ducts in the high-potential conduit line.

Operation.—As previously stated, the plant is operated twenty-four hours per day, except on Sunday, when it is operated during the day for about two hours at noon only. The motor-generator set is run from 7 a. m. to 10.30 p. m. only. This set is normally started from the alternating-current end, as the direct-current lines are dead when it is not running, unless the steam-driven set is running. The normal method of starting is to connect the synchronous motor to the busbars through the series reactors; then as the machine approaches synchronous speed, which usually takes about a minute, close the field switch; after the machine has dropped into step adjust the direct-current potential, and finally close the switch which short-circuits the reactors. The starting of this machine lowers the line potential for a minute or two, but as there are few lamps lighted at 7 a. m. this is of no great moment. When the steam-driven set is running the motor-generator can be started and run from the direct-current end, thus supplying alternating current to assist the hydraulic plant.

When the generators are operating in parallel the load is divided between them, according to the wattmeter indications, by operating the governor control switches while keeping the frequency constant. When adjusting the potential, by operating the field rheostats, the power-factors of the two generators are kept alike, as indicated by the power-factor meters. This method is much more satisfactory than the usual one of adjusting the field currents according to the indications of the main and field ammeters when adjusting the potential, both on account of the superior accuracy of the adjustment made possible and the smaller mental effort required. A test on one of the generators which was carrying a load of 58 kw showed the variations of power-factor and armature current with field current as indicated in Table I.

TABLE I.—TEST OF GENERATOR.

Field Current Amperes	Power-Factor Per cent.	Phase Difference Degrees	Armature Current Amperes
4	64.0	—50	20.0
5	75.0	—41	17.0
6	86.0	—30	15.5
7	97.0	—14	13.0
8	98.5	+10	13.0
9	91.0	+24	14.5
10	84.0	+33	15.5
11	66.0	+49	18.0

The comparison for sensitiveness should be made between the variation of phase difference and the variation of armature current, because power-factor meters have their needles deflected in direct proportion to the phase difference, while their graduations show the cosine of the angle of phase difference. This test shows that a change in the field current which does not affect the main ammeter appreciably causes a variation of twenty-four degrees in the position of the needle of the power-factor meter.

The operating force consists of the superintendent and two men; the former devotes about half his time to the plant, having his office adjoining the substation.

The load curves for Sept. 1, 1909; Dec. 1, 1909; March 1, 1910, and June 1, 1910, are shown in Fig. 3. The increase of the morning and evening load for March 1 over the load for Dec. 1 is due to the opening of the new Law Building. In this building there is a motor-driven ventilating fan, while the library is open until 10 p. m.

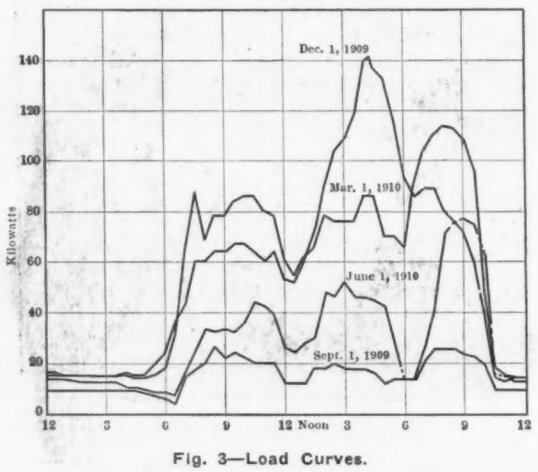


Fig. 3—Load Curves.

Finances.—A summary of the installation cost, the expense account and the output for the three years during which the plant has been operated is given in Table II. It will be noted that the total cost per kilowatt rating is rather high for a plant having such a small distribution system. This fact is due primarily to the high cost of the hydraulic development per kilowatt on account of the low head.

TABLE II.—FINANCIAL STATEMENT.

Investment Account	YEAR ENDING JUNE 30 1907	1908	1909	1910
Hydroelectric plant				
Land		$1,000.00	$1,000.00	$1,000.00
Building		3,800.00	3,800.00	3,800.00
Hydraulic works		22,000.00	22,000.00	22,000.00
Hydraulic equipment		8,500.00	8,500.00	8,750.00
Electrical equipment		3,400.00	3,443.00	3,525.00	3,825.00
Total		$38,700.00	$38,743.00	$38,895.00	$39,195.00
Substation		$3,000.00	$3,240.00	$3,240.00	$3,240.00
Transmiss and distribution		4,500.00	5,350.00	5,350.00	5,675.00
Reserve plant		2,500.00	2,500.00	2,615.00	7,135.00
Total investment		$48,700.00	$49,833.00	$50,100.00	$55,195.00
Depreciation Account				
Value of fund at begin. of year				$1,891.00	$3,914.09
Interest, 4%				$75.64	130.56
Machinery displaced					650.00
Hydroelectric plant				
Building, 2%			$76.00	76.00	76.00
Hydraulic works, 2%			440.00	440.00	440.00
Hydraulic equipment, 8%			680.00	680.00	685.60
Electrical equipment, 5%			170.00	172.15	176.25
Total			$1,366.00	$1,368.15	$1,377.85
Substation, 5%			$150.00	$162.00	$162.00
Distribution system, 5%			225.00	267.50	267.50
Reserve plant, 6%			150.00	150.00	156.90
Value of fund			$1,891.00	$3,914.29	$5,359.10

The cost of service per kw-hour is fairly low, due to the good load factor for a plant of this character.

TABLE III.—FINANCIAL STATEMENT.

Expense Account	YEAR ENDING JUNE 30 1908	1909	1910
Hydroelectric plant			
Fixed charges			
Interest, 6%	$2322.00	$2354.58	$2333.70
Depreciation	1366.00	1368.15	1377.85
Taxes, 1½%	580.00	581.14	583.42
Insurance, 1%	157.00	157.43	158.95
Maintenance	450.00	250.00	211.00
Total	$4875.00	$4681.30	$4664.92
Operation			
Superintendent (half time)	$450.00	$500.00	$500.00
Two operators	1320.00	1320.00	1320.00
Supplies	30.00	30.00	30.00
Total	$1800.00	$1850.00	$1850.00
Transmission and distribution			
Interest, 6%	$280.00	$321.00	$321.00
Depreciation	225.00	267.50	267.50
Taxes, 1½%	67.50	80.25	80.25
Total	$572.50	$668.75	$668.75
Reserve plant			
Interest, 6%	$150.00	$150.90	$156.90
Depreciation	150.00	150.00	156.90
Taxes, 1½%	37.50	37.50	39.22
Total	$337.50	$337.50	$353.02
Total expense for year	$7547.50	$7537.55	$7536.60
Total output kw-hours	209,093	236,073	294,251
Maximum load kw	148	155	166
Yearly load factor, per cent	16.1	17.4	20.8
Demand cost at switchboard, per kw	$32.90	$30.20	$28.20
Energy cost at switchboard per kw-hour	.0086	.0078	.0063
Total cost at switchboard per kw-hour	.0319	.0277	.0221
Total cost at buildings per kw-hour (20% allowance for loss)	.045	.040	.032

Hydraulic Data.—The maximum possible output of the generators, for various heads on the wheels, is as follows:

Head (feet)	3	4	5	6	7	8	9
Power (kw)	35	68	105	150	200	250	300

This table was compiled from tests for heads up to 6 ft., the output for greater loads being estimated. The majority of the time the head is between 7 ft. and 9 ft., as shown in Tables IV and V for the head of water on the wheels for two years.

TABLE IV.—NUMBER OF DAYS ON WHICH WATER WAS AT VARIOUS HEIGHTS ABOVE CREST OF DAM. HEIGHT GIVEN IN INCHES AT 7 A. M.

		Below	Above					
1908-9	Height	6 to 0,	0 to 6,	6 to 12,	12 to 18,	18 to 24,	24 to 30,	30 to 35
	Days ..	15	156	26	46	62	44	15
1909-10	Height	0 to 6,	6 to 12,	12 to 18,	18 to 24,	24 to 30,	30 to 36,	36 to 42
	Days ..	73	176	47	32	14	10	13

TABLE V.—EFFECTIVE HEAD ON WHEELS IN FEET AT 7 A. M.

1908-9	Head	3 to 4,	4 to 5,	5 to 6,	6 to 7,	7 to 8,	8 to 9,	9 to 10,	10 to 11
	Day..	4	18	56	59	43	148	36	1
1909-10	Head...	0 to 2,	2 to 3,	3 to 4,	4 to 5,	5 to 6,	6 to 7,	7 to 8,	8 to 9
	Days..	1	7	11	13	18	48	126	141

When the head is over 9 ft. the flow is so small that the full load cannot be carried for very long without drawing on the storage.

Interruptions to Service.—The service was interrupted or the steam plant run each year as follows:

TABLE VI.—INTERRUPTIONS IN 1907-1908.

July 10—Plant shut down at 8:20 p. m. on account of flood.
July 11—Plant shut down all day on account of flood.
July 14 to 16—Plant shut down all day on account of flood.
July 19—Load reduced at 7:00 p. m. on account of flood.
July 20 to 22—Plant shut down all day on account of flood.
Aug. 14—Plant shut down at 8:15 p. m. for the night on account of trouble with gate. 24-hour service not yet started.
Feb. 4—Steam plant run from 12:40 p. m. to 9:30 p. m. on account of low water.
Feb. 5—Assistance received from steam plant from 7:00 a. m. to 7:20 p. m. on account of low water.

TABLE VII.—INTERRUPTIONS IN 1908-1909.

July 2—Ten-minute shutdown at 6:35 a. m. for wheel repair.
July 11—Twenty-minute shutdown at 12:30 p. m. to line shaft.
Jan. 12 to 16—Part of the peak load carried by steam plant on account of low water.
Jan. 18 to 20—Part of the peak load carried by steam plant on account of low water.
Mar. 9—Part of the load at peak carried by steam plant on account of flood.
Mar. 31, April 1 2, 5, 16, 19, 20, 21, 22, 26, 27 and 28—Load reduced on account of high water.
Apr. 29, 30—Part of the peak load carried by steam plant on account of high water.
May 3, 5, 19 and 20—Load reduced on account of high water.

TABLE VIII.—INTERRUPTIONS IN 1909-1910.

July 7—Steam plant started at noon on account of high water.
July 8—Steam plant run all day on account of high water.
Dec. 3—Steam plant run 4:00 p. m. to 6:30 p. m., high water.
Dec. 6—Steam plant run 3:30 p. m. to 6:00 p. m., high water.
Dec. 7—Steam plant run 9:30 a. m. to ——, high water. Ice clogged racks so that plant had to be shut down at 8:30 p.m.
Dec. 8—Steam plant run until 6:00 p. m. Hydraulic plant started at 1:00 p. m.
Dec. 10—Steam plant run 2:30 p. m. to 5:00 p. m., high water.
Dec. 13—Steam plant run 2:30 p. m. to 4:30 p. m., high water.
Jan. 13—Steam plant run 2:30 p. m. to 6:00 p. m. Generator No. 1 out of commission, due to burn-out.
Jan. 17—Steam plant run 2:30 p. m. to 6:00 p. m. Generator No. 1 out of commission, due to burn-out.
Mar. 8—Steam plant run from 5:00 p. m. on account of high water. Hydraulic plant shut down at 10:00 p. m. Ice went out.
Mar. 9—Steam plant run until 10:00 p. m., high water. Hydraulic plant started at 2:00 p. m.
Mar. 10—Steam plant run from 5:00 p. m. to 10:00 p. m., high water.
Mar. 11—Steam plant run from 3:30 p. m. to 10:00 p. m., high water.

Where the load was reduced to avoid starting up the steam plant it was done, in most cases, by stopping some of the ventilating fans as the lighting load increased late in the afternoon. This change could be made without serious inconvenience, as few of the classrooms are occupied at this time of the day. A study of the interruptions to service shows that most of them were due to high water, as indicated in Fig. 4.

Fig. 4—View of Dam During High Water.

To insure continuous service it is necessary to have a power reserve of some sort with a sufficient equipment to drive at least one generator at full load. The gasoline engine at the substation serves this purpose, the possible output of the motor-generator set being 100 kw when driven from the engine. This engine was not put in service until May, 1910, so that the data given do not show its operation. An internal combustion engine is superior to a steam engine for such service because it can be put into service more quickly and requires no extra help for its operation.

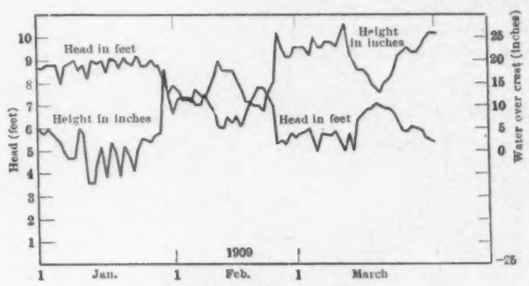


Fig. 5—Hydraulic Data.

A study of the hydraulic data for a period of low water followed by one of high water is interesting on account of the sudden changes shown. The data for such a period are shown in Fig. 5, the curves being plotted from data taken each day

at 7 a. m. During January the water was below the crest of the dam for a part of the time during nearly every day. The river was frozen over until the flood period in the latter part of February, during which the ice went out.

Experience with this plant has led the writer to draw the following conclusions: The cost of hydraulic works and equipment for plants having heads lower than 10 ft. is so great per kilowatt rating that such plants are apt to be unprofitable investments unless the yearly load factor is greater than 15 per cent. Where the water-power is as variable as in this case a reserve plant is a necessity. In case the maximum load is greater than the hydraulic power developed the load factor for the hydraulic plant can be materially increased by operating the rest of the plant only when the load is in excess of that which can be carried by the hydraulic plant, thus making the investment in the hydraulic plant a profitable one.

The field-circuit ammeter, which it is customary to place on a generator switchboard, can be replaced to great advantage by a power-factor meter.

THREE-PHASE TRACTION IN ITALY.

Some Practical Problems Encountered on the Three-Phase Giovi Line.

By Warren H. Miller.

UP in the mountains back of Genoa, Italy, near Lake Giovi, the Italian government has electrified a portion of the steam line running into Genoa from Milan via Novi and Pontedecimo, as mentioned in the *Electrical World*, Sept. 8. The mountains which encircle Genoa slope up very abruptly from the sea, rising to from 1500 ft. to 3000 ft., and the railroad follows the valley of the Pescara mountain stream down to the sea at an average grade of 2.7 per cent and a maximum of 3.5 per cent. The electrified section covers the grades from Pontedecimo to Busalla, a distance of about thirteen miles, and the Genoa tunnel through the mountains. Owing to favorable experience during the last seven years with the Valtellina Railway, the Italian government adopted three-phase traction for all its electric lines, including the 225-mile stretch from Lucerne to Chiasso over the Gotthard-Bahn, undertaken in conjunction with the Swiss State Railways. Mr. Karl von Kando, director-general of all of these electrical lines, succeeded in pushing the Giovi line, as the Genoa-Pontedecimo-Busalla section is called, through to operative completion during the past summer. The line, which is used mostly for freight traffic, operates thirty 2000-hp, 60-ton locomotives each with two 3000-volt, 15-cycle induction motors directly coupled by connecting rods to five wheels on a side. These locomotives were fully described in the issue referred to above, so that the present article will be limited to a study of the effects of three-phase traction on the generating equipment and the solution of overhead problems.

Fig. 2 shows the general arrangement of overhead lines. The two conductors are run side by side about 1 m apart, hung from a single catenary with flat tie-bars thinned down to a circular section at the junctions with the trolley wire and with the suspension wire.

A single trolley bow takes current from both wires, the roller of the bow being composed of two hard-bronze sleeves separated by a 30-cm insulated section and insulated by a bushing from a solid steel mechanical axle passing through them and carried by ball-bearing races at the ends. The wires are supported by long cantilevers made of two 6-in. I-beams extending from structural steel poles with three tie wires running to the top of the pole from points over the center of each trolley bracket and at the end of the cantilever. The idea in extending the arms so far beyond the outer wire is not only to get a firmer suspension of the wire, but to provide a strut for guy-wires in arranging cross-overs and turn-outs, when they prove exceedingly convenient in attaching anchor wires.

Fig. 3 shows details of the trolley wire hangers. There are two beam-clamps attached to the under flange of the cantilever I-beams and these grip the high-tension spool insulators. There are four of the latter, all identical, two of which are enclosed by the beam-clamps and two by the wire hangers. A 1.5-in. iron pipe, to which they are cemented, passes through them. The wire hanger-post has a movable clamp to adjust the height of the catenary suspension wire and a pair of parallel

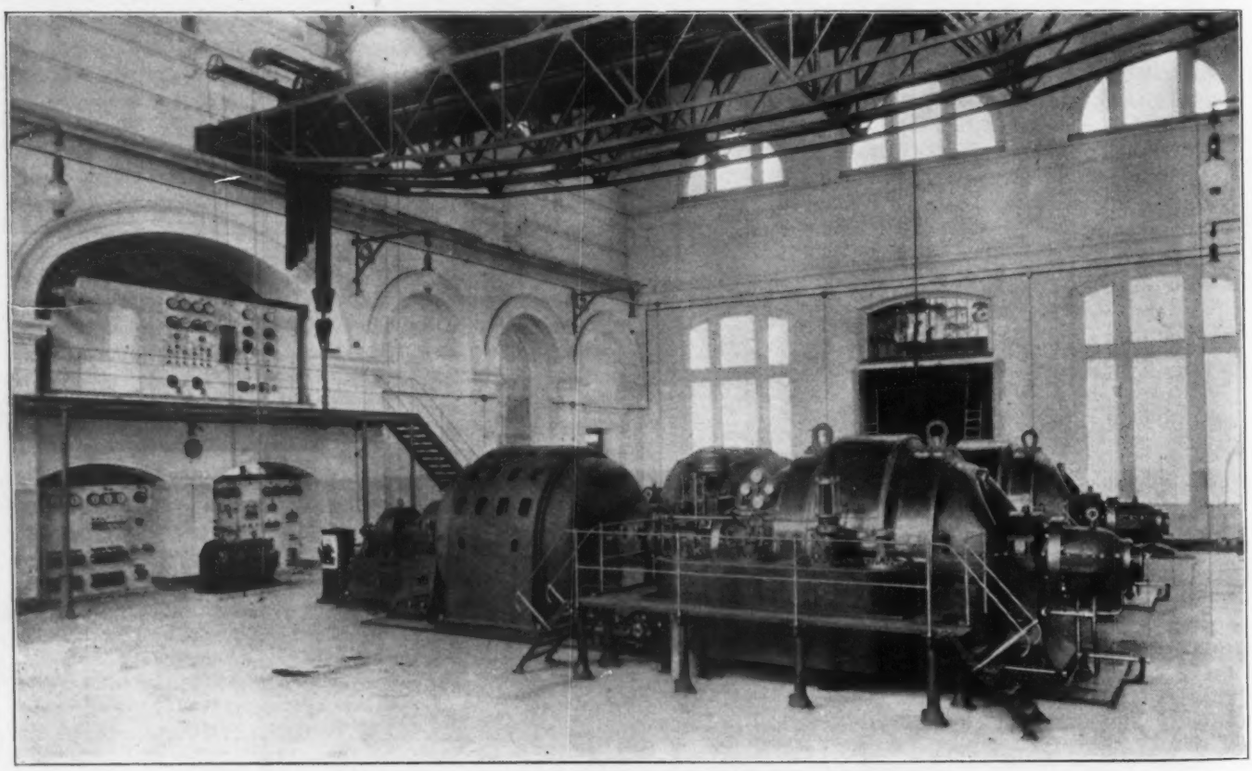


Fig. 1—Turbo-Alternators in Giovi Line Power House.

motion links holding the triangular frame to which the trolley wire is clamped. The latter is of T-rail section.

It has been found advisable not to put any collars over the insulated section of the trolley bow, nor to raise it above the periphery of the bronze sleeves. There is practically no swaying of the bow in practice, and even if one wire were to travel over on the insulated section the motors would simply be operated single-phase for a moment. The bow frame is raised up by compressed air pistons equipped with a suitable oil damper, which will permit slow changes of level of the wires above the top of the rails from 15 ft. to 19 ft., but resists instantly any shocks or jars tending to throw the bow out of contact while running.

It is in the overhead work that the three-phase presents undoubted disadvantages over the single-phase. There are many roads where the extra cost of a double-wire system would prohibit its use. Besides the extra cost there are the greater complications of a double trolley line. However, the possibility of three-phase traction under all sorts of heavy service has been proved beyond doubt, and there are at least three European firms of the first rank prepared to undertake such con-

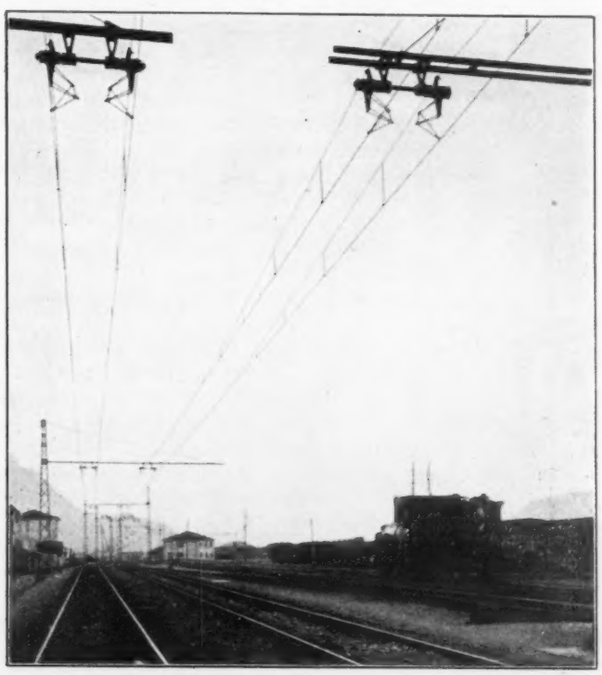


Fig. 2—Overhead Construction of the Three-Phase Giovi Line.

struction under bonds for its successful operation. For a line having heavy traffic and many locomotives it is the cheaper installation in the long run. It works out as follows: At 100 sq. mm of copper cross-section of trolley wire the difference of cost of installation between the double wire and the single wire runs from $700 to $800 per kilometer. Taking the specific case of the Gotthard-Bahn, there are 367 km of track between Lucerne and Chiasso, or 440 km, including stations and yards. This puts the difference in cost of a double line against a single at between $308,000 and $352,000. When this difference is offset against the greater cost of the single-phase locomotives, about seventy-five locomotives will be the least that will be wanted. (There are now on the line 169 steam locomotives.)

At the price of $28,000 per locomotive, the total will run $2,100,000 for locomotives. As the single-phase locomotives cost about 17 per cent more per ton, the difference will amount to $357,000, thus balancing the extra cost of wire. The real difference will be much greater, since it takes twice as much weight of single-phase locomotives to move the tonnage over heavy grades as with the three-phase. This means extra locomotives on heavy trains, so that the real outlay for single-phase locomotives will far overbalance the extra cost of the double-wire overhead work.

Fig. 1 is a view of the interior of the generating station with the two 6000-kw, 3000-volt, 15-cycle turbo-alternators as installed by the Société Anonyme Westinghouse, of Havre. The locomotives, one of which is shown in Fig. 4, were built at

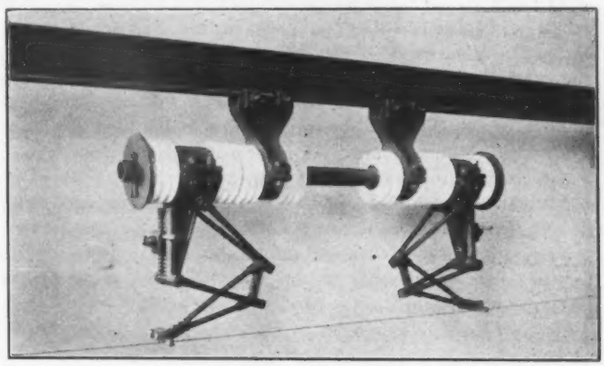


Fig. 3—Three-Phase Hanger Details.

the shops of the Italian Westinghouse Company at Vado Ligure, on the Mediterranean coast.

Regarding the economy of the three-phase equipment for the generating station, it is well known that with the same output the single-phase equipment costs about 40 per cent more than the three-phase. This is not the only advantage, for experience has shown that on overload the single-phase alternators are subject to exceptional eddy currents which produce corresponding overheating, so that still larger machines must really be provided and the actual constructive material takes the proportion of about 3 to 2 as compared to a three-phase alternator of equal power. On the other hand, the single-phase equipment has a somewhat simpler and less expensive switchboard arrangement, having only two poles instead of three in switches, breakers, etc. This advantage should not be overestimated, since the three-pole breakers have only one-third the current to handle for the same total power sent out and only one more pole than the single-phase.

Fig. 5 is a view of the outgoing feeder panels. These panels are provided with two-pole combined oil-switches and breakers and an 800-amp ammeter in each of the two overhead legs. The adjacent panel has a single-pole circuit breaker connection to the ground circuit or third-phase lead. On the outging lines are two choke-coils and low-equivalent lightning arresters.

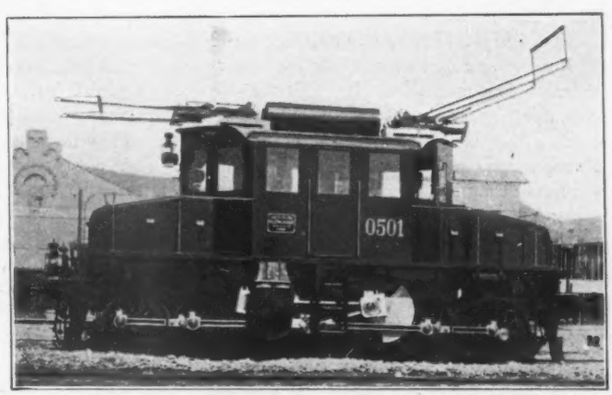


Fig. 4—Three-Phase, 60-ton Freight Locomotive for Giovi Line, Italian State Railways.

These are of the well-known American type, with a set of milled cylinders, series gaps, a second set of shunted gaps consisting of similar cylinders around which is a resistor and, finally, a heavy non-inductive resistor in series with the gaps, which latter is connected to ground. A lightning discharge passes over both series to ground through the main resistor.

Any arc which follows it is opened by the actions of the shunt and series resistors together, while the initial flow is kept down by the series resistor.

The question of voltage enters strongly into any consideration of the respective merits of the three-phase and single-phase equipments. With three-phase it has developed into a medium e.m.f. on the trolley line of 3000 volts (6000 volts in the Cataract Tunnel line of the Great Northern) and for single-phase it has reached 15,000 volts in the Seebach-Wettingen line. The advantages in copper economy are self-evident when the further simplicity of avoiding transformers on the locomotive can be obtained. But high voltages in the locomotive introduce very heavy insulation in the motors, making it difficult to get an economical design for the rotor and stator slots. It is difficult to provide a strong, well-insulated overhead system for the high-tension lines, and hence the problem is one of long-distance transformer substations distributed along the line with a moderate voltage taken off the trolley line directly into the motors, or else transformers on the locomotive with a fairly high voltage on the trolley line.

Mr. von Kando's argument in solving the problem in figuring energy economy and installation costs for the Lucerne-Chiasso line is as follows: With seventy-five locomotives he found that, allowing 1600 kw in transformers for each, 120,000 kw of transformers would be needed as extra installation charges,

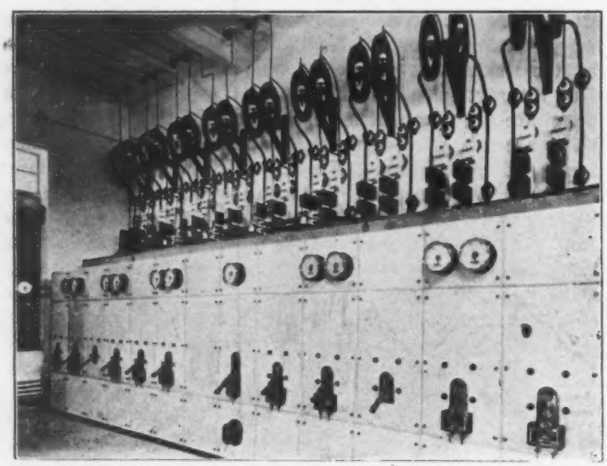


Fig. 5—Outgoing Feeder Panels, Giovi Line Power House.

whereas the average power over the whole line used throughout the day was 20,000 kw, whence only this amount would be needed in substation transformers, the expense being only one-sixth as great as when installed on the locomotives. On the Valtellina line 3800 kw of transformer substations suffices in practice to serve 18,000 hp of total locomotive motor rating. Assuming 15,000 kw of transformers needed on these locomotives, 4-to-1 is the ratio of expense of locomotives with transformers versus substations. On the Giovi line, with transformers at both ends feeding energy to the line in two directions, the entire transformer equipment rating is 12,000 kw to serve a total of 50,000 hp in electric locomotives. Taking 40,000 kw of transformers as needful on the locomotives there is still 3.5 times the transformer expense. However, the locomotive equipment of this line can be very much increased without overloading the transformer substations as already installed.

The above, however, takes the hour-load rating of the locomotive transformers against the day-load rating of the substation transformers. Therefore the size and cost of the former may be only one-half that of the latter. Even then the cost remains three times as great in the theoretical case of the Lucerne line and twice as great in the actual case of the Valtellina line. One might also urge the cost of buildings and switch panels of the substation transformers, but these are balanced by the increased cost of the locomotives in their mechanical part due to having transformers installed, their extra switching and controller complications, division of switch-rooms, etc.

Aside from the cost advantages there is an operating advantage in the line using substations over that using high-tension transformers on the locomotives, especially in large installations. On dead short-circuit with turbo-alternators of great kinetic energy no breaker can handle the tremendous rush of energy, whereas with substations and step-up transformers a short-circuit on the road is dampened by them enough to allow the circuit to be opened safely at the generating station.

In general, in choosing between the two forms of alternating-current traction, it is necessary first of all to provide sufficient load equipment and adaptability for the special service of the particular road and not to try to compete with steam locomotives with lighter or scarcely heavier electric locomotives. The selection of the details can then be decided by the specific technical advantages, such as the simplicity of the single-phase overhead or the traction advantages of the three-phase, as fits best the particular line.

RECENT STUDY OF THE FIREFLY.

By Herbert E. Ives.

In the summer of 1909 the present writer, with Dr. W. W. Coblentz, obtained a photograph of the spectrum of the firefly's light. The photograph showed the light to consist of a narrow band of radiation confined to the yellow and green region of the visible spectrum. On the assumption that this photographed light constitutes the total radiation from the insect it would follow that the firefly is the most efficient known illuminant. It was calculated that its radiant output corresponds to nearly fifty candles per watt, as against the two or three candles per watt of the most efficient mercury arcs or flame arcs.

At the time of the publication of that work some question was raised as to the validity of assuming the visible radiation to be the only radiation. This assumption was based on Professor Langley's bolometer measurements made twenty years ago. These proved that the emission of light by the firefly is accompanied by an exceedingly small amount of heat as compared with any artificial illuminant of the same brightness. Examination of his work shows that it is not actually proved, however, that the visible radiation is the total radiation. It is nevertheless probable, and in the graphical comparison so often copied from his paper this assumption is embodied.

Perhaps our greatest interest in the study of the firefly lies in answering the question: Has Nature actually produced the most efficient possible light? If so, then we may hope some day to do the same. If, as is usual in Nature, a process of selection has been gone through, we may expect to find other light-producing substances of similar nature but of wider color range. Although of lower efficiency as light producers, these would be more acceptable to human use. If, on the other hand, the firefly light should be proved not the ideally efficient radiation it has been supposed, but merely an approximation, our interest in it would be materially reduced, and our hopes of securing a similarly efficient, but more pleasing, light would lose much of their support. It becomes, therefore, of importance to know definitely if the conclusion of Professor Langley is true.

Langley's experiments in brief were these: Bolometer deflections were obtained from the total radiated energy of the insect—none or next to none when that having a wave-length longer than 3μ was obstructed by a glass screen. On the other hand a flame of the same brightness as the firefly gave considerable deflections of the bolometer through the same glass. The radiation obstructed by the glass Langley classed as "body heat" due to the bodily temperature of from 40 deg. C. to 50 deg. C. Specifically the criticism of his work is this: In those cases where no deflections were obtained all of the bright visible radiation was incident upon the bolometer. Since

this had little or no effect, could there not be radiation anywhere between it and 3μ of similar order of magnitude? If, for instance, the spectrum consists of several bands of nearly equal intensity, their existence would have escaped the tests imposed. Had the bolometer been sensitive enough to respond unquestionably to the visible radiation, the point at issue could have been determined by absorbing that radiation by a properly chosen red glass and then noting the remaining deflection, if any.

This summer an attempt was made to extend the definite knowledge of the firefly's light into the infra-red region. A bolometer of great sensitiveness for this purpose was not available, so another method of investigating the infra-red was tried. It will be remembered that the great advantage of photographic observation over visual lies in the integrative action of the photographic plate, which adds the effect due to each flash of the firefly. There was some promise that the method used this summer would possess this desirable characteristic in respect to the infra-red, and might therefore be superior to the bolometer. This method is that of phosphor-photography used by Draper, Lommel and others. Phosphorescence, which is excited in certain substances by blue, violet or ultra-violet light, is extinguished by yellow, red or infra-red radiation. The extinction may be recorded by taking a photograph of the phosphorescent surface. In this way photographs of the infra-red spectrum of the sun and of various elements have been obtained.

Phosphor-photography was investigated at length with a view to applying it to this study. The various tests will be given in detail elsewhere in the fuller publication of the work of which this is an abstract. The conclusions reached in brief were as follows: Sidot blende, the most suitable phosphorescent substance, is sensitive to reducing action as far into the infra-red as 1.5μ; it is sensitive for four or five hours after excitation; the reducing action is, like photographic action, integrative; finally, the sensitiveness to reduction is of nearly the same order of magnitude in the infra-red as it is in the visible region at 0.57μ. The importance of this last observation lies in its making possible a rigid proof of the main point at issue, for if reducing action is produced by the visible firefly radiation, but not with the visible radiation obstructed, then none of similar magnitude exists in the region to which the Sidot blende is sensitive.

Fireflies caught in Druid Hill Park, Baltimore, were studied by the phosphorescence method. It was found that an exposure of only twenty minutes to the firefly flashes was sufficient to produce strong reduction of phosphorescence. On the other hand, an exposure of three hours and a half through a ruby glass, opaque to yellow-green light but transparent to infra-red, produced no effect. It therefore appears that there is no radiation between the visible region and 1.5μ of the same order of magnitude as the visible radiation.

At the same time advantage was taken of the opportunity to search for ultra-violet radiation by means of a quartz spectrograph. The photograph obtained showed a strong impression from the light at 0.57μ, but no trace of action elsewhere. The result was thus again negative, so that in the whole region from 0.2μ to 1.5μ there was found no radiation except that previously investigated at 0.57μ.

Following these experiments some tests were made to see if the firefly's light possesses any of the characteristics of true phosphorescence; that is, whether it is emitted only after previous exposure to light. Experiments of this kind were suggested by observation of the effect of warming a phosphorescent substance during its period of decay. Warming produces a flash of light very similar to the flash of the firefly. While no great confidence was felt that the insect's light would prove of this character, it was thought at any rate worth while to apply some of the characteristic tests of phosphorescence. These are: First, dependence upon previous exposure to light; second, sensitiveness to excitation by ultra-violet light; third, sensitiveness to reducing action by infra-red rays.

To none of these tests was there any positive response. Insects kept in the dark for twenty-four hours and those open to the light behaved exactly the same. Infra-red and ultra-violet light had no effect on the insects or upon the luminous matter removed from their abdomens. The only observed effect of light was that strong illumination caused the living insects to cease flashing as though from realization of the futility of their own light. Their light is therefore not true phosphorescence.

The results of the present investigation may, therefore, be said to be entirely negative, but so far as they go they lend probability to the supposition that the visible radiation is the only radiation other than "body heat." The spectral region in which we have definite knowledge has been extended to cover the interval from 0.2μ to 1.5μ. It has been surmised by Coblentz that the abdominal skin of the firefly, being a complex organic substance containing water, is opaque beyond 2μ, so that 2μ, or perhaps 1.5μ, is the limit of the possible radiation. If so, the present investigation would cover nearly the whole region of interest. Following the work described above a bolometric test was made of a piece of this skin to obtain information upon this point. It was found that the skin in its natural thickness is about as transparent in the deep infra-red (about 3μ) as at the edge of the visible region. It is hence possible that radiation of wave-length greater than 1.5μ is produced and can pass out through the skin. There still remains for investigation, therefore, the radiation of wave-lengths greater than 1.5μ to which the phosphor-photographic method is not sensitive. As to the mode of light production, no positive information has been obtained, but by the exclusion of phosphorescence it is made still more probable that the insect produces its light by some unknown, but not necessarily unknowable, bio-chemical process.

MULTI-SPEED SQUIRREL-CAGE INDUCTION MOTOR.

Comparison of Multi-Speed Induction Motor with Direct-Current Series Motor.

By R. E. Hellmund.

THE squirrel-cage induction motor, on account of the absence of all moving contacts and insulated conductors on the rotor, is the most rugged and simple electric motor now built, and because of its mechanical superiority it is especially well adapted to industrial and other severe services. In cases where frequent starting under load is necessary, the ordinary induction motor is at a considerable disadvantage due to its inherently constant speed. For intermittent service involving high starting torques the direct-current series motor is well adapted; however, this motor requires a more expensive distribution system and heavier maintenance charges than does a corresponding induction motor.

In view of these facts, the writer has designed a multi-speed squirrel-cage induction motor which comes within the economic limits set by the series motor and at the same time compares favorably with the latter as regards its starting and operating characteristics.

Practically all large electric systems now furnish alternating current, and in this article the distribution system is assumed to carry alternating current. A direct-current motor will, therefore, require a corresponding equipment of transforming devices, such as synchronous converters and transformers or motor-generator sets. In view of these facts, it appears to the writer that an additional investment in the induction motor itself, in order to obtain characteristics approaching those of the series motor, is amply justified even from a purely commercial standpoint.

In order to demonstrate these views, the writer has designed a squirrel-cage motor which is somewhat larger than a normal

constant-speed induction motor and a good deal heavier, but only moderately more expensive than the corresponding direct-current motor. It is equivalent to a direct-current series motor having a full-load rating equal to that of the induction motor at its highest speed. The general data for the motor are as follows: Terminal e.m.f., 3000 volts; frequency, 25 cycles; with dimensions in inches, the product D^2L in the air-gap is 49,000; the weight of active core iron is

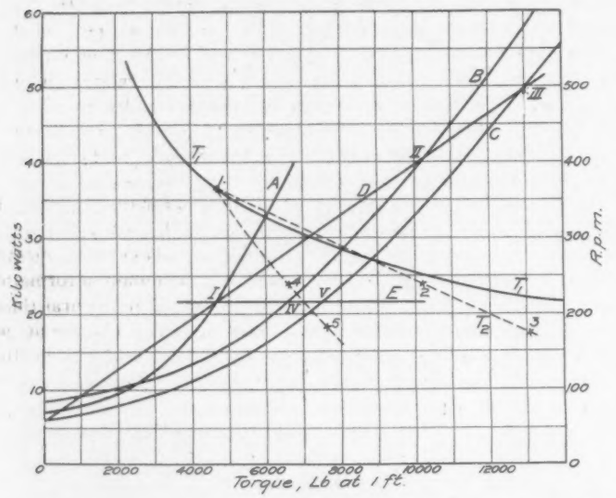


Fig. 1—Curves of Comparative Losses and Speed Torque of a Direct-Current Series Motor and Multi-speed Squirrel Cage Induction Motor.

5500 lb.; the weight of active copper is 1900 lb. The over-all dimensions of the frame are: Height and diameter, each 75 in.; width, 40 in.

The multi-speed feature is obtained by providing the motor with two two-speed windings in the primary, which correspond to 24, 16, 12 and 8 poles, giving as synchronous speeds 125, 187.5, 250 and 375 r.p.m. respectively. The motor is designed to operate at only the three higher speeds, the lowest speed being used only for starting. Forced ventilation is employed.

The curves *A*, *B* and *C* in Fig. 1 show the losses in the motor for the three operating speeds in terms of torque at 1 ft. radius. The ventilation of the motor is such that it will dissipate 39,000 watts continuously. Making considerable allowance for starting losses, it was determined that the admissable full-load losses could be taken as 21,800 watts, which corresponds to a rating of 325 hp at 365 r.p.m. (Point *I* on curve *A*.) For the purpose of comparison, assume a direct-current series motor with the same continuous rating, normal speed and losses. Curve T_1 in Fig. 1 shows the ideal speed-torque characteristic of this series motor, the speed decreasing in inverse proportion to the torque. The copper losses in this motor will increase in approximate proportion to the torque, other losses not being materially affected. Therefore, the total loss in the motor is a straight-line function and is represented in Fig. 1 by line *D*. It will be noted that this line crosses curve *B* in point *II*, and curve *C* in point *III*, which determine the speeds at which the losses in the two motors are equal. The ability of the motors to carry the loads represented by the points *I*, *II* and *III* depends upon their radiation power, and although assumed to be equal in this case, that of the induction motor, on account of its larger masses, is superior.

The speeds of the induction motor corresponding to points *II* and *III* are indicated by points 2 and 3 on the dotted curve T_2, which may be considered as representing the speed-torque curve of the induction motor. The proximity of the curves T_1 and T_2 indicate that the imitation of a series characteristic has been practically attained. It would be well to point out here that the induction motor has a very important advantage over the series motor in that it can carry at low speeds for an indefinite time torques largely in excess of its full-load torque, while the series motor can do so for only a limited period. This characteristic is shown by drawing a horizontal line *E*, which corresponds to the continuous loss previously assumed. This line cuts curves *B* and *C* in the points *IV* and *V*, the corresponding speeds being indicated by the points 4 and 5 on the curve, which is plotted through these points. This curve may be considered as the continuous rating speed-torque curve of the induction motor, and ratings corresponding to this curve and the performance of the motor at these rating are given in the table herewith:

Cont. rating h.p.	Spe'd r. p. m.	Torque Lb. at 1 Ft. Rad.		Efficiency at Various Loads				Power Factor at Various Loads			
		Cont. rating.	Pull out.	0.50	0.75	1.0	1.50	0.50	0.75	1.00	1.50
325	365	4,670	16,700	92.2	92.5	91.7	89.6	86	91.5	93.5	94.8
300	240	6,550	29,700	90.0	91.5	91.1	89.5	65	79	85	89.5
265	182	7,650	24,800	89.5	90.5	90.0	87.5	59	72	80	86.5

It will be seen that the efficiencies are high and compare favorably with the direct-current series motor. They are considerably higher than would be attained by those of a direct-current machine operating in connection with transforming devices from an alternating current system. From an operating standpoint the series motor has the advantage of being able to run at any speed between the limiting ones, while the induction motor is confined to three positive speeds. However, the plain series motor is limited to one speed for each torque, while the induction motor may be operated near each of its synchronous speeds at any torque between zero and maximum; by the use of shunt field circuit regulation with a direct-current machine, this latter characteristic may also be obtained within certain limits.

In order to attain a satisfactory starting characteristic special provisions have been made. As was previously stated, the lowest speed is used for starting only, and therefore it was possible to provide means for rendering this step particularly effective. A special arrangement of secondary resistor rings

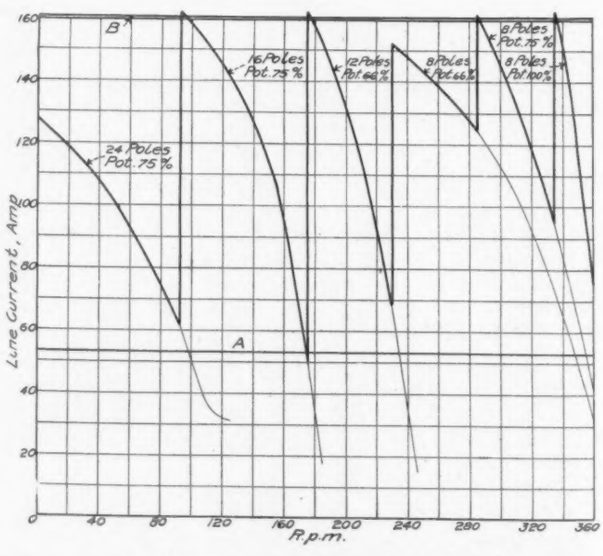


Fig. 2—Curves of Current of Multi-speed Squirrel Cage Induction Motor During Starting Period.

was devised by which the bars are connected through these rings in such a manner that the effective resistance of the rotor is high for the lowest speed and low for the three operating speeds. In order to reduce the complication and expense of control apparatus to a minimum, only two starting potentials, namely, 66 and 75 per cent, have been used.

As starting conditions, it has been assumed that the current shall not exceed three times the full-load current and that the

motor shall start under load, which is equivalent to accelerating a mass of 375,000 lb. at 1-ft. radius. In order to gain a proper conception of this last condition, it might be stated that starting with full-load is equivalent to the acceleration of a 190-ton train to a speed of about 26.5 miles per hour.

Speed torque curves for the various steps during the period of acceleration are shown in Fig. 3, while Fig. 2 gives the corresponding current values. Only the lower voltages are used at the low speeds. This was done in order to simplify the control equipment, and although by using also full potential on each speed connection the acceleration might have been somewhat more rapid, and the extra expense would not have been justified by the slight gain that would be obtained. In Fig. 2 the straight line *A* indicates the full-load current, while line *B* shows the maximum permissible current, which is three times the full-load current. Line *A* in Fig. 3 represents the full-load torque, while line *B* shows the total resisting torque, an allowance having been made for the friction of rest. In order to simplify calculations, it has been assumed that the speed-torque curves in Fig. 3 could be represented by the straight dotted lines as shown. From an examination of the curves it is evident that the distances between these dotted lines and the lines *A* and *B* represent the torque values available for acceleration. These values have been replotted in Fig. 4, and based on these curves

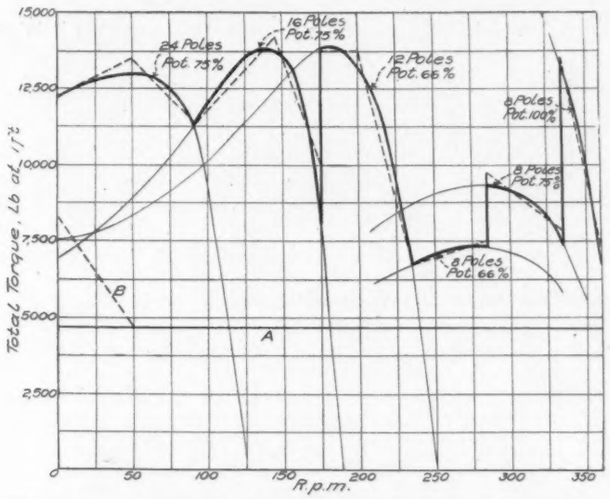


Fig. 3—Speed Torque Curves of Multi-speed Squirrel Cage Induction Motors.

the curves shown in Fig. 5 have been constructed. Curve *A* shows the speed plotted with time. It will be noted that the acceleration takes place at a fairly uniform rate and is completed in a period of about 88 seconds. Curve *B* shows the losses corresponding to the above speed-time curve. The total acceleration losses amount to 5.6 kw-hours. As previously mentioned the motor can dissipate continuously 39,000 watts, but at full load the losses are only 21,800 watts; therefore, distributing the starting losses over the running period in such a way that the average losses come up to 39,000 watts, it is found that the motor may be started from rest with full load every $(1000 \times 5.6 \times 60 \times 60) \div (39{,}000 - 21{,}800) = 1175$ seconds = 19.6 minutes, and carry its rated load continuously.

The above assumed conditions are exceedingly severe, and will practically never occur in industrial work. The mass to be accelerated is usually less than one-quarter of the value assumed above. Assuming quarter load acceleration, the motor will carry its rated load continuously and start every five minutes without exceeding its normal working temperature.

From the above discussion, it is evident that this type of induction motor would withstand almost every starting service which will normally be encountered in practice, except perhaps certain cases where the motor is called upon to reverse every three or four seconds, as when operating reversing rolling mills.

Attention might be called to the fact that the total starting loss is generally decreased by an increase in starting voltage. Increasing the starting voltage increases the current and therewith the losses. However, the starting torque also increases, and by reducing the period over which these losses take place the practical result usually is that the total energy lost during starting is reduced when the voltage is increased. For ex-

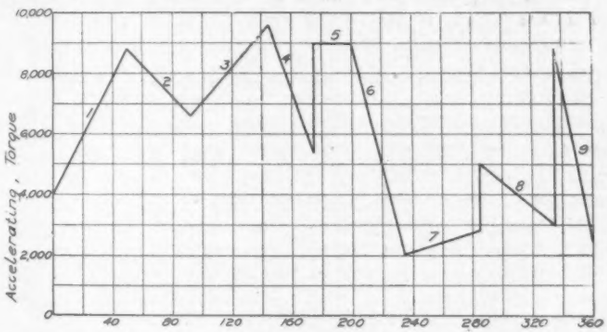


Fig. 4—Torque of Multi-speed Induction Motor Available for Acceleration.

ample, in the present instance, for the starting period of Fig. 4, for a starting voltage of 60 per cent the loss is 4.36 kw-hours, while on the other hand, with a voltage of 66 per cent, as shown in the curves, the loss is only 1.78 kw-hours. For this reason it is always advisable to choose a starting voltage as high as possible, with due regard to other conditions, such as line current, mechanical limitations, sparking in the controller, etc.

The control apparatus for a multi-speed induction motor of the type discussed involves certain difficulties, since the power which must be handled by the switches is larger than it would be in a corresponding series motor. However, in the matter of expense there is a considerable margin between the direct current and the induction motor outfits, which may be balanced against the increased cost of the induction motor controller. Naturally the induction motor will affect the line and generator

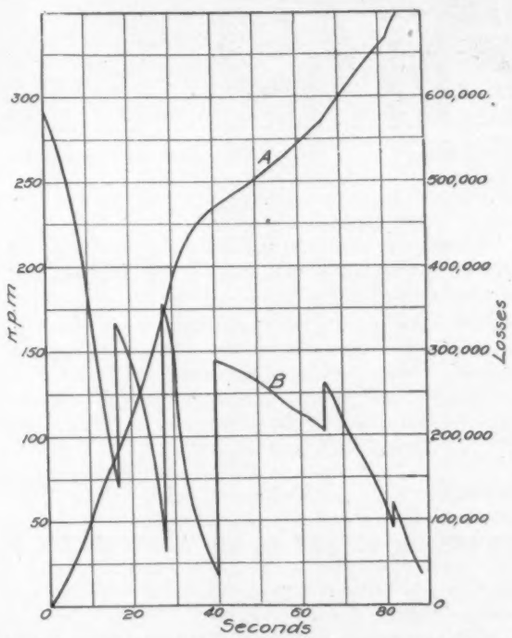


Fig. 5—(A) Speed-Time Curve of a Multi-speed Induction Motor; (B) Starting Losses of Multi-speed Induction Motor.

during its starting period more than will a series motor. However, by referring to Figs. 2 and 3 it will be seen that the increase of current during the starting period over the full running load value is accompanied by a corresponding increase of torque above the normal full-load value, which is a compensating advantage.

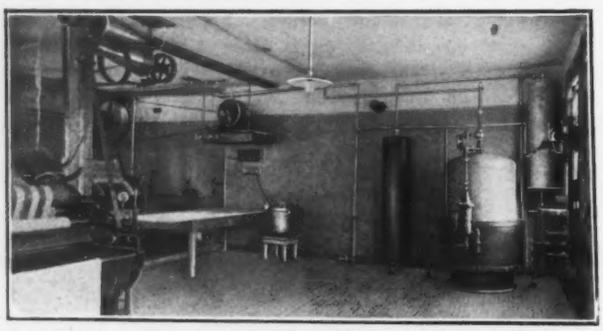
Central Station
Management, Policies and Commercial Methods

A CASTLE-FORM CENTRAL-STATION BUILDING.

The new municipal electric generating station to be erected at Halle, in the north-central part of Germany, will be given the architectural form of an ancient castle, complete with towers, turrets, gables, battlements, buttresses and donjon-keeps. The massive main tower will be an eight-sided structure, 95 ft. high and 35 ft. in diameter, marking its practical purpose as a cooling tower for lowering the temperature of the condenser circulating water. The tower will stand at the center of a courtyard, 80 ft. x 60 ft., surrounded by a moat and by a wall 31 ft. high. The whole design has been prepared by one of Germany's leading architects, who has planned many of the castles of the nobility, and the idea for this odd central-station structure is due to the superintendent of the Halle municipal plant, Mr. Jung.

ELECTRICALLY HEATED LAUNDRY.

The accompanying illustration shows the interior of the electrically heated laundry at the Hotel Stanley, Estes Park, Col., to which reference was made in the issue of Aug. 25. The electrical equipment of this room includes an 85-kw, 250-gal. boiler generating steam at 80 lb. per square inch; a 20-kw circulation-type water heater connected to the 600-gal. hot-water tank, and a 6-gal. starch cooker.



Electric Steam Boiler and Water Heater in Hotel Laundry.

The electrically heated steam boiler is the large jacketed cylinder at the right of the picture, and supplies steam for heating the rolls of the 60-in. mangle at the left and also for heating the water for the washing machine in the background. These machines are, of course, motor-driven. The tall black cylinder at the left of the steam boiler is the 20-kw water heater, which is one of four in use in the hotel for supplying the guest-rooms, toilets, laundry and kitchen. The kettle shown at the center is the starch cooker.

INCREASE IN MOTOR LOAD AT WINONA, MINN.

A successful effort has been made, and is being made, by the Winona Railway & Light Company at Winona, Minn., to develop the business of supplying electrical energy to motors. For instance, the gross receipts for "commercial power" in June, 1909, were $2,406, and in June, 1910, $7,509. A more detailed statement of the comparative gross earnings of the company for July, excluding railway earnings, is given in the following tabulation.

Mr. F. H. Plaice, who has been manager of this company since Sept. 3, 1909, is a firm believer in the desirability of increasing the motor load. He thinks that any central-station company which has fostered a motor load as it should do will find that its revenue from the sale of electricity for motors is such a large percentage of the whole that fluctuations in the demand for electricity for lighting, due, for instance, to the introduction of the tungsten lamp, will hardly be noticed. He believes that the ratio of central-station lighting earnings compared to earnings from motor service should be not greater than 1 to 3, and with most companies the proportion of earnings from motor load should be considerably greater than this.

	July, 1909	July, 1910
City arcs	$1,049.66	$1,082.33
Commercial lighting	3,902.05	5,424.21
Motor service	1,974.71	9,390.42
Total	$6,926.42	$15,896.96

Mr. Plaice thinks that any company depending upon lighting for its revenue may find itself sooner or later greatly handicapped by reason of the reduced income derived from customers on account of the substitution of tungsten lamps for carbon lamps. Therefore, it is of great importance to rely on the motor load as the principal source of revenue. In Winona it is not thought desirable to encourage the use of tungsten lamps smaller than the 40-watt size, while it is considered that for general purposes the 100-watt size is as small as can be pushed to good advantage. The latter lamp, however, forms a somewhat unwieldly unit for residence purposes and calls for considerable judgment in installation.

ELECTRIC-SIGN AND FLAT-IRON CAMPAIGNS IN TORONTO.

In January, 1910, the Toronto Electric Light Company inaugurated an electric-sign campaign which has been highly successful. A very low rate was offered for the energy used by signs "off the peak," the charge being 8 cents per month per 2-cp, 14-watt lamp, or 5 cents per kw-hour for "off-peak" sign loads. The signs have been sold outright to the different merchants, the two local sign companies having taken care of all financial arrangements, except the consumption of the energy.

FREE TRIAL IRON ORDER
Toronto, ... 19 .....
Sales Manager,
Toronto Electric Light Co., Limited
Please send me, without obligation on my part, one six-pound Electric "Glad" Iron which I promise to try for thirty (30) days. If I find I can do without the appliance at the end of the trial period, I will notify you to remove the Iron. I understand the price is Six Dollars ($6.00), including attachments, payable in monthly instalments of One Dollar ($1.00) with my electric light bill.
Name
Address
Electric Iron

Fig. 1—Flat-Iron Order on Postal Card.

Some of the signs that have been erected are very striking. The *Saturday Night*, a weekly paper, on Sept. 24 printed four photographs on its front cover showing electric-sign installa-

tions. The *News* contained a two-column article on the number of electric signs, and other papers gave shorter notices.

The *Saturday Night* makes use of an immense fountain sign on a roof at the corner of Yonge and Queen Streets, a like sign at the corner of College and Spadina, and a vertical sign on the façade of its building on Adelaide Street. The Red Rose Tea Company has a very elaborate sign representing tea flowing from a pot into a cup; the steam rises, and the whole

Fig. 2—Electric Sign in Toronto.

is very striking and effective. A certain "Fairweather's" sign is of the rocket type; the rocket flies upward and falls into varicolored streams of light, which in turn break forth into the word "Fairweather's." The Brown Furniture Company has

Fig. 3—Electric Sign in Toronto.

lately installed a sign of a jumping rabbit that is very striking. "Adams," a rival concern, has installed a lightning sign. The Salada Tea Company has a sign on the roof of its building with letters 10 ft. high, in four rows, with 16-cp lamps in each letter. This is a very striking advertisement. One of the large bakers has installed an immense sign with 4-ft. letters reading "Eat Bredin's Bread" on the roof of the large bakery; this sign may be read by the passengers coming into Toronto on the steam trains. The business is taken "off the peak" without any trouble. In an eight-month campaign there have been installed over 100 signs ranging in price from $250 to $2,700.

On April 1 the Toronto Electric Light Company started an electric-iron campaign, the irons being placed on trial for thirty days. The irons are of United States manufacture and owing to the high duty on them, each 6-lb. iron is sold for the relatively high price of $6, which covers also a self-contained switch.

In inaugurating the campaign all of the residence customers of the company were solicited by young ladies after other plans had been tried and found unsuccessful. One of the schemes tried was that of delivering the irons from the company's wagons after letters had been sent to the customers stating that the irons would be sent and a demonstrator would be provided in case the irons were accepted. This plan had proved successful in introducing toasters but proved ineffective with the irons. The direct-solicitation plan has been highly fruitful of results. Two wagons were kept busy delivering the irons, and at the end of thirty days' trial over 75 per cent of the irons were retained by the customers.

Nearly 2000 irons have been sold in this way to date, and the demonstrating solicitors report that the people are highly pleased with the results.

The company augmented the soliciting canvass with advertisements in the daily papers, sent enclosures with its bills to residence consumers and gave office demonstrations. Use is now being made of post cards, such as are shown on the preceding page, which are sent out with the monthly bills to the present customers.

In order to maintain proper interest in the flat-iron campaign and ensure a sale of irons during the coming winter months, the company displayed on the roof of its booth at the Canadian National Exhibition an electric sign 21 ft. by 14 ft., showing a G.E. model flatiron. The iron was complete with switch, cord, etc., and was accompanied by the words, "Electricity Makes the Sad Iron the Glad Iron," arranged with 14-in. letters. The iron was outlined continuously, but the wording alternated with two rockets which flashed into many colored stars.

A SAFE ENERGY RATE FOR SMALL CENTRAL STATIONS.

By S. W. Borden.

The principles governing the making of central-station rates have been pretty fully discussed of late and need not be gone into here. It is taken for granted that most companies prefer a rate which will produce a fixed income for fixed expenses and a profit on each kw-hour measured by a customer's meter, and it has been contended that an ideal rate should be capable of producing an equal net profit from each dollar of investment and each kw-hour manufactured. The author believes that such a rate is not a practical one at the present time, especially for small companies, as it seems to be necessary to accept a smaller profit from some classes of business in order to develop them to the best advantage and thus reap the greatest ultimate reward. For example, the fixed charges on small residential lighting must be kept pretty low in order to secure this class of business at the present time, and a smaller profit per kw-hour must be taken from large "long-hour" users in order to close down private plants and do the cooking for the hotels.

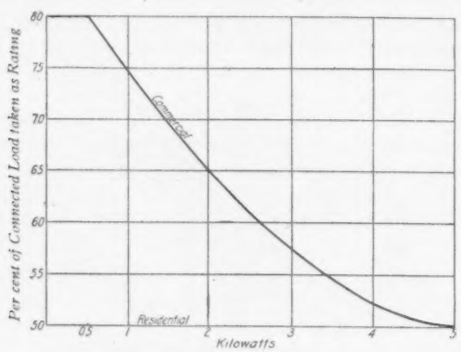
When adopting a new rate of this kind it is not good policy, even though franchises and the law permit, to make the new rate compulsory. The fixed charge should be made high enough at the start so that should all those customers who would profit by it accept it and all those who would not profit by it reject it the loss to the company would not be great.

With this start the company is in a position to make a fairly good proposition to any long-hour user, whether he be an old customer desiring increased consumption or a new customer. As fast as the increased business permits, the fixed charge should be reduced and at the same time the old rates should be put as much in the background as possible finally being made into a special rate if it is not possible to eliminate them entirely without causing too much trouble from the short-hour users.

The manager must decide what constitutes "peak load" and "off-peak load" for his particular business and what he will place in the "residential class" and what in the "commercial class." He must be permitted to exercise his business-getting ability and to adapt the rate to the business without adapting the business to the rate and he must know how much it costs to turn out one more kw-hour than his present output.

This system calls for the classification of each customer in accordance with certain rules and regulations, but in case the rating thus obtained is not satisfactory to either the central station or the customer it may be checked by means of a curve-drawing instrument, the rating for peak-load business being taken as the average demand during the one hour of the station's maximum demand and that for off-peak business as one-half of the customer's maximum one-hour demand at any time.

The service is divided into two general parts, "peak" and "off-peak" business. Peak business is subdivided into commercial and residential. Residence ratings are taken at 50 per cent of the connected kilowatts irrespective of the size of the installation. Commercial services of 5 kw connected and over are taken at 50 per cent and below 5 kw in accordance with the curve herewith reproduced. "Off-peak" business should be rated as follows:



Division of Peak Business.

TABLE I.

Connected Load in Kw.	No. of Appliances	Per Cent.	Class (for Reference)
0—7.5	One	40	OPA
0—7.5	Over one	35	OPB
7.5—40	Any Number	30	OPC
40 and over	Any Number	25	OPD

In classes OPB, OPC and OPD the rating must not be less than the rating of the largest single device alone.

Mixed loads should be rated as follows: When the peak load predominates the peak portion should be classed at the regular peak-load rating and nothing should be added for the "off-peak" portion. When the "off-peak" load predominates the peak portion should be classed at the regular peak-load rating and to this should be added the "off-peak" rating for an "off-peak" load equal to the difference between the "peak" and "off-peak" loads.

The minimum rating in all cases must be such as to produce a service charge of not less than $1.00 per month. All ratings should be expressed in kilowatts and fractions thereof.

The rate will consist of two parts, a service charge and a consumption charge as follows:

X dollars per kilowatt of rating per year and 5 cents per kw.-hour, or

X plus $20.00 per kilowatt of rating per year and 4 cents per kw.-hour, or

X plus $40.00 per kilowatt of rating per year and 3 cents per kw.-hour, or

X plus $60.00 per kilowatt of rating per year and 2 cents per kw.-hour, or

X plus $80.00 per kilowatt of rating per year and 1 cent per kw.-hour

The above prices cover the lamp renewals (ordinary) for "peak-load" customers. In case the "peak-load" customers do not require lamp renewals no deductions will be made. In case "off-peak" customers require lamp renewals an additional charge of 0.5 cent per kw-hour must be made.

The value of X must be determined for each central station individually and also, as before stated, the lowest rate permissible must be decided upon individually. When the lowest rate has been decided the intervening rates should be eliminated since any customer who earns a lower rate than the 5-cent rate will, at the same time, earn the lowest rate. The turning point from the 5-cent to the lowest rate will come when the customer has used his rated load five hours per day or his connected load approximately as in Table III.

TABLE II.

USE OF CONNECTED LOAD HOURS PER DAY					KW-hours consumed per month per KW of rating	CONSUMPTION CHARGE 5 CENTS PER KW-HOUR						CONSUMPTION CHARGE 2 CENTS PER KW-HOUR					
						SERVICE CHARGE PER KW OF RATING											
						$20 per Year		$40 per Year		$60 per Year		$80 per Year		$100 per Year		$120 per Year	
	Off Peak Classes																
Peak Class 50% Rating	OPA	OPB	OPC	OPD		Total monthly charge, dollars	Cents per KW-hour	Total monthly charge, dollars	Cents per KW-hour	Total monthly charge, dollars	Cents per KW-hour	Total monthly charge, dollars	Cents per KW-hour	Total monthly charge, dollars	Cents per KW-hour	Total monthly charge, dollars	Cents per KW-hour
¼	0.2	0.175	0.15	0.125	15	2.42	16.1	4.08	27.2	5.75	38.4	6.97	46.5	8.63	57.5	10.30	68.7
½	0.4	0.35	0.30	0.25	30	3.17	10.6	4.83	16.1	6.50	21.7	7.27	24.2	8.93	29.8	10.60	35.3
¾	0.6	0.525	0.45	0.375	45	3.92	8.7	5.58	12.4	7.25	16.1	7.57	16.8	9.23	20.5	10.90	24.2
1	0.8	0.7	0.6	0.5	60	4.7	7.8	6.33	10.55	8.00	13.33	7.87	13.13	9.53	15.9	11.20	18.7
2	1.6	1.4	1.2	1.0	120	7.67	6.4	9.33	7.75	11.00	9.20	9.07	7.55	10.73	8.88	12.40	10.33
3	2.4	2.1	1.8	1.5	180	10.67	5.9	12.33	6.85	14.00	7.78	10.27	5.70	11.93	6.65	13.60	7.55
4	3.2	2.8	2.4	2.0	240	13.67	5.7	15.33	6.40	17.00	7.10	11.47	4.78	13.13	5.48	14.80	6.15
5	4.0	3.5	3.0	2.5	300	16.67		18.33	6.11	20.00	6.67	12.67		14.33	4.78	16.00	5.33
6	4.8	4.2	3.6	3.0	360	19.67		21.33	5.95	23.00	6.38	13.87		15.53		17.20	4.78
7	5.6	4.9	4.2	3.5	420	22.67		24.33	5.8	26.00	6.20	15.07		16.73		18.40	
8	6.4	5.6	4.8	4.0	480	25.67		27.33	5.7	29.00	6.05	16.27		17.93		19.60	
9	7.2	6.3	5.4	4.5	540	28.67		30.33		32.00	5.93	17.47		19.13		20.80	
10	8	7.0	6.0	5.0	600	31.67		33.33		35.00	5.85	18.67		20.33		22.00	
11	8.8	7.7	6.6	5.5	660	34.67		36.33		38.00	5.77	19.87		21.53		23.20	
12	9.6	8.4	7.2	6	720	37.67		39.33		41.00	5.70	21.07		22.73		24.40	
13	10.4	9.1	7.8	6.5	780	40.67		42.33		44.00		21.27		23.93		25.60	
24	19.2	16.8	14.4	12.0	1440	73.67	5.12	75.33	5.23	77.00	5.35	35.45	2.46	37.13	2.58	38.80	2.70

For shorter use than this the 5-cent rate will be the cheapest and for longer usage the lower rate will be the cheapest. In Table II is the total bills per kilowatt of rating per month and the net rate paid for different hours of use for

TABLE III.

Lighting (50% class)	2.50 hours per day
Class OPA	2.00 hours per day
Class OPB	1.75 hours per day
Class OPC	1.50 hours per day
Class OPD	1.25 hours per day

a service charge of $20, $40 and $60 per kilowatt of rating per year and a 5-cent rate per kw-hour and the corresponding figures for a low rate of 2 cents per kw-hour.

Wiring and Illumination

ORNAMENTAL ARC-LAMP POSTS.

Arrangements have been completed for decorating the arc-lamp posts along Market Street in Philadelphia with flower boxes placed at a height of about 12 ft. above the street. This arrangement, which is the result of a design submitted by Chief McLaughlin, of the electrical bureau, has been approved by Mayor Reyburn. The cost of maintaining the flower boxes will be met by Market Street merchants. The flower boxes will be constructed of wrought iron, with divisional interior boxes for holding the plants and flowers and for draining them,

LIGHTING OF SUNKEN GARDENS.

Interesting lighting effects are obtained in the new Sunken Gardens on the West Side in Denver. These gardens are built on bottom land, filled in by the city along Cherry Creek, and constitute a municipal improvement. A feature is a pergola presented by the Westinghouse Electric & Manufacturing Company. There is a small artificial lake supplied with water by means of a dam built in the creek. Grass has been planted in the gardens, and next spring trees and shrubbery will be set out. Several hundred incandescent lamps are arranged along the surface of the water under the coping of the concrete wall which surrounds the lake. They are in various colors and give first red, then white and then blue light. The effect of this light so near the surface of the water is very pleasing. The pergola is also electrically lighted. During the winter the lake will be used for skating and will be illuminated for that purpose. The Sunken Gardens will be one of the city's beauty spots. They are noteworthy because less than two years ago the site was a dumping ground and an eyesore to the community.

ARC LAMPS FOR PROJECTION.

By Henry Phelps Gage.

The arc lamps used for projection purposes, such as the "magic" lantern, the projection microscope and moving-picture machines, are in general of three types: (1) With inclined carbons (Figs. 1 and 2); (2) with electrodes at right angles (Fig. 3); (3) with converging electrodes (Fig. 4). The first two are used on either direct current or alternating current the third is used only on alternating current. The last named has the advantage that the hot tips of both electrodes throw the light forward, but is open to the objection that there are two sources of light instead of one. The most favorable condition is when the source is a single point of light. When there are two sources of light, if the lantern is not in perfect focus, the picture instead of being merely hazy is doubled, which is very trying to the eyes.

The right-angle lamp is the most satisfactory for many purposes, as the upper electrode feeds forward and is always in the axis of the optical system. However, the inclined-electrode arrangement is the one most frequently used.

EXPERIMENTS MADE AT CORNELL AND IN SCHENECTADY.

Investigations of the subject of illuminants for projection have been carried on for some time in the Physical Laboratory at Cornell University. Candle-power measurements have been made with alternating current and with direct current. These tests showed so favorably for direct current that the General Electric Company at Schenectady was asked for similar figures on the direct current furnished by the mercury-arc rectifier. When tests were made for this purpose the author was invited to assist.

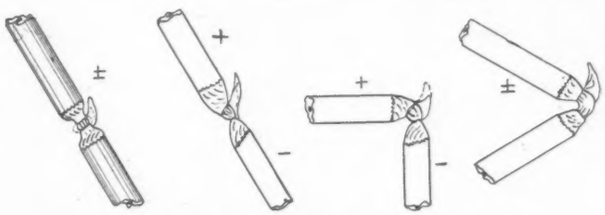
The results with alternating current and direct current were in very close agreement with those previously obtained at Cornell, and hence, to avoid confusion, only the results of the Schenectady tests are given here.

The experiments were made in the illuminating engineering laboratory of the General Electric Company. The apparatus was a Lummer-Brodhun photometer 20 ft. from the arc, used in connection with a 3-to-1 or 5-to-1 sectored disk and a 35-cp tungsten incandescent lamp. Ten settings were made for each current. One person made all of the settings of the photometer, so that any error due to differences in color would be the same for all readings. Measurements were made of the candle-power of the various lamps in the direction of the axis of the lantern in which they are to be used.

The sources were:

1. Inclined-electrode lamp such as is used in moving-picture outfits; 5/8-in. cored carbon electrodes. Tested with from 20-amp to 60-amp, alternating-current electrodes held as in Fig. 1.

2. Same kind of lamp except that direct current was used. The upper electrode was positive and great care was taken to



Figs. 1, 2, 3 and 4—Arrangement of Arc Lamp Electrodes.

hold the position of the electrodes, as shown in Fig. 2, so that the crater faced forward. This is the best position and gives the most light. Whenever the arc is too short the lower electrode shades part of the crater and a great deal of light is lost.

3. The same as 2 except that the direct current was supplied by a mercury-arc rectifier.

4-6. Similar measurements made on a lamp with right-angle arrangement, the electrodes being held as in Fig. 3.

Besides the candle-power, measurements were made of all electrical quantities. The results are given herewith in the form of tables and curves.

REGULATION OF CURRENT AND LOSSES.

The energy delivered at the arc depends only on the current and voltage (the power-factor with alternating current is nearly 1.0), but the energy drawn from the line, which is what the consumer pays for, depends also on the kind of apparatus used for "ballast," such as a resistor or a choke coil.

For direct current a rheostat is generally used. As much energy is wasted in the rheostat as is used at the arc, for the pressure across the arc is only about 55 volts, while commercial lighting systems have a 110-volt supply. The difference is lost in the rheostat. There is available a kind of rotary converter which if used on a 110-volt supply will deliver from 30 volts to 70 volts, depending on the current drawn. This

machine consumes little energy in friction and is much more economical than a rheostat.

For alternating current either a resistor, a reactor (choke coil), a transformer or a rectifier may be used. The alternating-current arc is usually operated with inclined electrodes

TABLE I.—DIRECT CURRENT; INCLINED ELECTRODES.

Amps.	Volts	Watts	Watts 110-Volt Line With Resistance	Candle Power
15	50	750	1,650	3,490
20	50	1,000	2,200	4,900
25	51	1,270	2,750	6,220
30	53	1,590	3,300	8,750
40	51	2,040	4,400	12,350
Mean	51			

TABLE Ia.—DIRECT CURRENT; ELECTRODES AT RIGHT ANGLES.

10	56	560	1,100	2,300
15	50	750	1,650	3,680
20	52	1,020	2,200	6,230
25	62	1,550	2,750	7,500
30	58	1,740	3,300	10,150
Mean	55.6			

and uses only 30 volts across the terminals. When used with a resistor the efficiency is very low. When used with a choke coil the efficiency is good (92 per cent), but there is such a low power-factor (30 per cent) that many lighting companies will not permit its use. To overcome this disadvantage a step-down transformer in connection with a small choke coil is employed. This arrangement gives the usual high efficiency of a transformer and a reasonable power-factor (96 per cent efficiency and 85 per cent power-factor).

Direct current is preferable to alternating current and for difficult projections such as with the microscope it is a neces-

TABLE II.—ALTERNATING CURRENT; INCLINED ELECTRODES.

Amps.	Volts	Watts	Line Watts		Candle Power
			With Resistor	With Transformer 96 per cent. Efficiency	
20	28	560	2,200	585	620
25	27.5	687	2,750	715	894
30	26.5	795	3,300	830	1,700
40	27	1,080	4,400	1,130	1,830
50	35	1,750	5,500	1,830	4,566
60	32	1,920	6,600	2,000	4,650
Mean	29.2				

Power factor at arc nearly 1.00

TABLE IIa.—ALTERNATING CURRENT; ELECTRODES AT RIGHT ANGLES.

10	44	430	1,100	450	590
15	42	600	1,650	625	763
20	47	920	2,200	960	1,050
25	57	1,370	2,750	1,430	1,690
30	57	1,600	3,300	1,570	2,540
Mean	49.6				

Power factor at arc 0.964

sity. When only alternating current is available a motor-generator set could, of course, be used, but a much simpler method is to use the mercury-arc rectifier. The primary of the rectifier is connected to either a 110-volt or a 220-volt alternating-current supply, and the secondary direct current is connected directly to the arc. The regulation ballast is a choke coil connected in the alternating-current side. There being no resistance, there is no loss except in the rectifier tube itself. The current furnished by the rectifier is not quite continuous, but is pulsating. As might be expected, there is a slight flicker in the light which can be seen if one is looking for it, but it is not at all noticeable as it is when using alternating current. The light for the same current is practically the same as with direct current supplied from a generator.

BEHAVIOR OF THE ARC WITH DIFFERENT CURRENTS.

In an alternating-current arc the light comes from the white-hot ends of the electrodes. With the direct-current arc the light comes mostly from the brilliant crater of the positive electrode.

With low currents and cored carbon electrodes the behavior of the arc is satisfactory, but at greater currents the soft core

TABLE III.—RECTIFIER; INCLINED ELECTRODES.

Direct Current Secondary			Alternating Current Primary						
Amps.	Volts	Watt	Amps.	Volts	Watts	Volt Amps.	P. F.	Eff.	C. P.
15	51	765	7	175	1,100	1,225	.898	.695	3,100
20	54.5	1,090	9.5	188	1,500	1,786	.84	.727	4,720
25	54	1,350	12	194	1,900	2,330	.816	.711	6,470
30	62	1,860	14.5	220	2,600	3,190	.816	.716	8,600
40	52	2,100	19	215	3,120	4,070	.768	.672	12,150
Mean	54.7						.828	.704	

TABLE IIIa.—RECTIFIER; ELECTRODES AT RIGHT ANGLES.

10	58	580	5.5	195	850	1,070	.794	.683	1,900
15	45	675	7	180	1,000	1,260	.793	.675	3,000
20	51	1,020	10	203	1,500	2,030	.739	.680	5,600
25	66	1,650	12	235	2,300	2,820	.816	.718	7,370
30	62	1 860	14	233	2,600	3,260	.798	.716	9,450
Mean	56.4						.786	.694	

begins to burn out faster than the end of the electrode, resulting in a hissing and sputtering of the arc, which leads to an unsteady light.

The lamp with the right-angle arrangement cannot be used much above 25 amp on account of the "magnetic blow" effect of the current. Many electrodes cause sputtering at currents above 30 amp and it is difficult to get a good arc with currents above 40 amp either alternating or direct.

With alternating current and inclined electrodes it is possible to get as much as 5000 cp with 60 amp. This arrangement gives an uncertain light, because the arc wanders around the carbon tips and the hot spot is often at the back of the electrode.

TABLE IV.—POWER IN KILOWATTS DRAWN FROM THE LINE FOR DIFFERENT VALUES OF LIGHT. INCLINED ELECTRODES, 110-VOLT SUPPLY, TRANSFORMER 96 PER CENT EFFICIENCY.

Candle Power	Kilowatts				
	D. C. at Arc	D. C. Resist.	A. C. Trans.	A. C. Resist	Rectifier
1,000	——	——	.6	2.7	——
1,500	——	——	.8	3.2	.7
2,000	.4	1.1	1.1	3.75	.8
2,500	.55	1.3	1.2	4.3	.9
3,000	.6	1.5	1.4	4.9	1.1
4,000	.76	1.9	1.7	5.8	1.3
5,000	1.1	2.25	2.0	6.9	1.5
6,000	1.2	2.6	——	——	1.8
7,500	1.45	3.1	——	——	2.15
10,000	1.8	3.8	——	——	2.75

A steadier light is obtained with the right-angle arrangement for all currents up to 25 amp.

COMPARISON OF ALTERNATING AND DIRECT CURRENT.

A comparison of alternating current and direct current shows that the energy consumed at the arc with alternating current is nearly twice as great as with direct current and a much higher amperage is needed. Taking 40 amp as the upper limit for

satisfactorily working an arc, the light available is limited to 2500 cp. Now, 2500 cp can be got with from 10 amp to 13 amp direct current depending on the style of lamp used; with 40 amp direct current 12,000 cp is possible.

For good results on a 15-ft. screen[1] there should be at least 2500 cp with the magic lantern and 4000 cp with moving-picture lamps. However, a fairer test is to compare the power drawn from the line with available apparatus. For 2500 cp 1.3 kw would be drawn from the line using direct current, 1.2 kw using alternating current with a transformer, and 0.9 kw using the rectifier.

TABLE V.—LIGHT GIVEN FOR DIFFERENT VALUES OF KILOWATT CONSUMPTION.

Kilowatts	Candle-Power				
1.0	5,500	2,000	2,200	———	3,200
1.5	7,800	3,000	3,400	———	4,800
2.0	12,000	4,300	4,800	500	6,900
3.0	———	7,300	———	1,300	11,000
4.0	———	11,000	———	2,200	———
5.0	———	———	———	3,100	———

DATA AND CURVES.

The results of the tests are recorded in Tables I to V and plotted in Figs. 5 to 8. Fig. 5 shows the relation between the current and the candle-power for lamps using inclined electrodes, while Fig. 6 shows the same relation for right-angle lamps. These illustrations show that for the same amperage the direct current gives the most light, the rectified current gives almost as much and the alternating current gives only a very small amount (one-fifth as much).

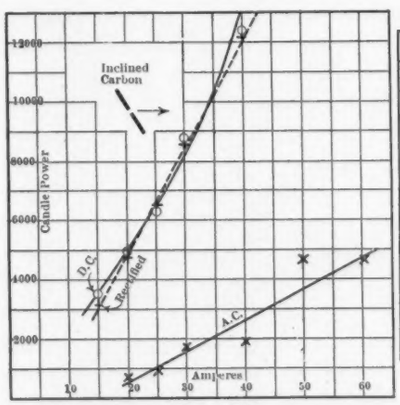


Fig. 5—Relation Between Current and Light in Inclined-Electrode Lamp.

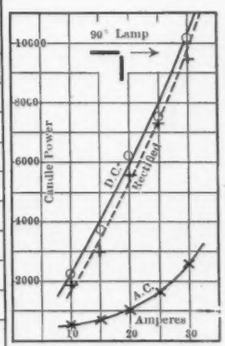


Fig. 6—Relation Between Current and Light in Right-Angle Lamp.

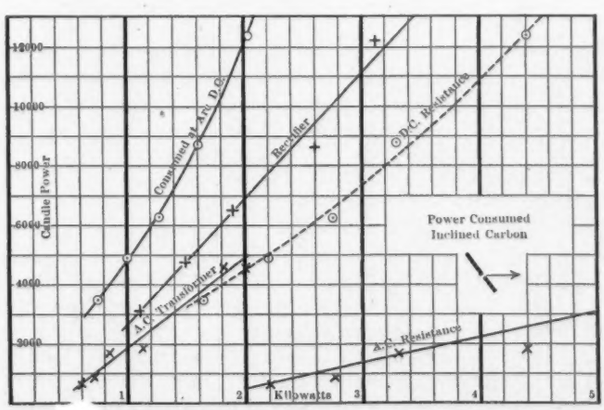


Fig. 7—Relation Between Power Consumption and Light in Inclined-Electrode Lamp.

[1] Experiments showing this result are in progress at Cornell University.

Figs. 7 and 8 show the relation between candle-power and power input. The top curve gives the power in kilowatts actually consumed at the arc with direct current. All other curves represent the power drawn from the line with existing apparatus. The power drawn from line through the mercury-arc rectifier was delivered to the arc at 70 per cent efficiency. This power is about the same as would be required if direct current were available at 75 volts instead of 110 volts. The power drawn from line with direct current and a rheostat is based on a line e.m.f. of 110 volts. The power drawn from line through a transformer was delivered at 96 per cent efficiency, the power consumed at the arc being slightly less than the value shown. The power drawn from line with alternating current and a resistor is for a line e.m.f. of 110 volts. This method is extremely wasteful; it is employed on small installations which are used only a few times a week. Fig. 9 illustrates the low power-factor obtained when using a choke coil as ballast.

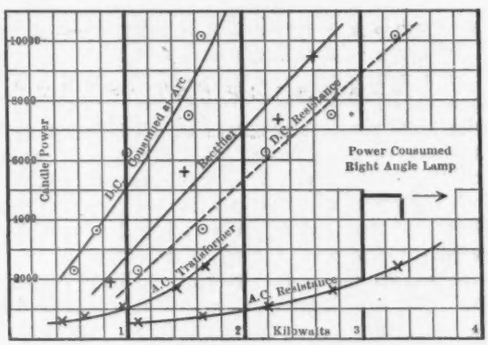


Fig. 8—Relation Between Power Consumption and Light in Right-Angle Lamp.

If the sets of curves for the right-angle lamp and those for the inclined-electrode lamp are compared it will be found that the right-angle lamp gives the most light for the same current in every case. The light given for the same power input is the same with rectified current for both styles of lamp. With either alternating current or direct current and resistance the right-angle lamp gives the greater light, but with alternating current and a transformer the right-angle lamp gives less light.

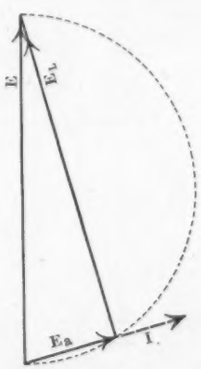


Fig. 9—Vector Diagram of Voltage Relation.

CONCLUSION.

Direct current obtained from a rectifier gives almost as much light as direct current from a generator. In every case direct current gives much more light for equal current values than does alternating current.

Evidently the power drawn from the line depends upon the power consumed at the arc and the efficiency of the ballast or transforming device. Of the devices tested the rectifier was the most efficient, and the least efficient was a resistor used with alternating current.

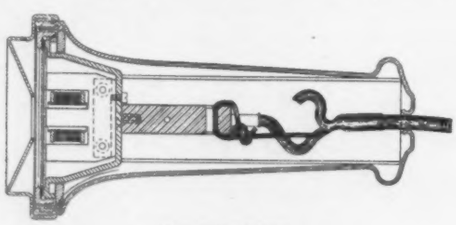
NEW TELEPHONE PATENTS.

SELECTIVE IMPULSE SENDER.

With all automatic systems the sender must cause a prescribed number of impulses to be sent out on the line, each group of impulses being separated by a short interval. Usually such senders are arranged so that each digit or figure is sent by an individual manual operation. However, in the sender recently patented by Mr. E. E. Clement, of Washington, D. C., the desired number is set up and then sent by a single sending operation A knob is provided for each digit, which is carried by a stem projecting through a notched slot in the body of the sender. Each notch is numbered. When the desired number is set up the operating crank at the end of the case is given a turn, whereupon the sender acts to deliver all necessary impulses. The mechanism is very simple. A single wheel sends all impulses. Its periphery carries several groups of 10 teeth each with blank spaces between. One group is for each digit. Upon the side of the wheel is a raised flange for each group of teeth, the flange being of the same angular length as the corresponding group of teeth upon the periphery. Each flange has a different length radius. When all the knobs of the sender are at zero, if the wheel be turned, as each group of teeth comes under the contact maker the stem of the knob corresponding will bear upon the flange. It must be understood that each stem is so formed and of such length as to strike only the flange corresponding to its own group of teeth. The electrical circuits are so arranged that the contact between a flange and a knob stem is a shunt upon the impulse contact maker. Thus with the knobs at zero no impulses occur. With the knobs displaced as many impulses occur at each set of teeth as there are teeth of that set which pass the contact maker before the flange reaches the displaced knob stem. The North Electric Company is assigned this patent.

METAL SHELL RECEIVER.

In the cut is shown in section a metal shell hand-type receiver invented and patented by Mr. W. W. Dean, of Elyria, Ohio, his patent being assigned to the Dean Electric Company. An insulating tube within the shell protects the receiver body from



Dean Receiver.

the rear of the shell. The receiver cup is supported by an insulating ring which rests upon the shoulder of the shell, as shown. The diaphragm is clamped to the cup by a threaded flanged ring and an insulating flange surmounts the flanged ring and lies between it and the ear cap.

INTERCOMMUNICATING SYSTEM.

An intercommunicating system forms the subject of a patent issued to Mr. W. W. Hawkins, of Cleveland. A novel feature is an electromagnetic release device for the keys. If the key at any station be depressed while the receiver is on the hook and so left, an arriving call will serve to shift the locking device and thus restore the key to normal.

AUXILIARY EARPIECE.

There are several kinds of auxiliary earpieces, one type of which is connected by a flexible tube to a sound box inserted in the regular receiver between the diaphragm and the ear cap. The present patent, granted jointly to Mr. K. Nichols and Mr. S. W. Nichols, of Newark, N. J., relates to the sound box, which in this case has a conical bore. Thus, while the base of the cone is of practically the same diameter as the diaphragm, the apex end is of the same diameter as the sound aperture of the ear caps.

SERVICE METERS.

Mr. O. C. Dennis, of Chicago, has patented a call counter for telephones with a rebate device. It is intended to operate interchangeably with prepayment coin collectors. The counter is located at the subscriber's premises and must be operated by a push to initiate a call. The operator is then able to give credit for the call in case it fails or to count it if it succeeds. This is accomplished through a polarized control magnet operated over the telephone line. For a credit call the operator lifts the operating pawl clear of the counter wheel.

Another meter patent has been granted to Mr. A. M. Bullard, of New York City. His patent relates to the use of push-button meters with semi-automatic or other systems where the potential existing upon the sleeve wire of the jack is likely to vary in sign according to the connection existing. His device consists of a combination of polarized relays such that the counter current supply is automatically shifted to conform to that existing on the sleeve at the time. Both the above patents are assigned to the Western Electric Company.

LETTERS TO THE EDITOR.

The Constitution and General Welfare.

To the Editor of Electrical World:

Sir:—It is not, I suppose, to be wondered at that technical writers should not be familiar with the Constitution of the United States and with the decisions interpreting it any more than that lawyers should be ignorant of technical matters; but the editorial in the issue of Sept. 22 seems to the writer to assume, as things admitted fully and about which there can be no controversy, matters which have been definitely closed to all discussion by decisions of the Supreme Court of the United States to the contrary.

In dealing with the advisability of "conservation," so called, being undertaken by the United States and not by the several states, the editor draws conclusions from an assumed case of a river flowing across the boundary line between two states, and assumes as quite a matter of course that in that case the federal government can and should act. That precise case was before the Supreme Court of the United States and is one of the most conclusive which that court has ever decided, the decision being unanimous by all of the nine judges. It is reported as Kansas vs. Colorado, 206 U. S., 46. No longer ago than November this case was cited with full approval, on this very point, by the Supreme Court.

There the two states differed as to their use of the waters of the Arkansas River; and because of that river's relation to certain works undertaken by the federal government, the United States, by its attorney-general, sought to intervene. The Supreme Court refused to permit intervention upon the distinct ground that, the river being not navigable and the works undertaken by the United States not being within the authority of any power granted in the Constitution, they had no right to interfere with the river or to intervene so as to be heard concerning the disposition made of its waters by the authority of the two states.

The second underlying assumption is that the federal government, or to be specific, the Congress, may do anything which it decides to be for "the general welfare." That is not the law. The United States may carry out to any extent which in their discretion is desirable any of the powers granted them by the Constitution, and no others. It is not strange that in the midst of popular clamor at the present time, most often raised by interested parties, such a view should be assumed to be correct by persons unfamiliar with the course of decisions in the Supreme Court; this is particularly true when even a United States judge in a very recent case has stated that "Congress is given the power to provide for the welfare of the United States." The words upon which this interpretation is based are as follows:

"The Congress shall have power:

"To lay and collect taxes to provide for the common defence and general welfare."

It would be too didactic and would take too much of your space to cite decisions and expound the full meaning of the clause; but the "general wefare" clause, so-called, is a *restriction* upon the power of taxation, and is not a power in itself. The decisions and the text-books upon constitutional law all uniformly so explain it.

Indeed, this must be so, or else the Constitution becomes mere waste paper, so far as any definition of constitutional powers is concerned, for if the Congress may do anything which it conceives to be for the general welfare then there is no need for any further consideration of the Constitution.

The third matter of criticism in your editorial is the sentence:

". . . Yet in cases of possible or probable conflict between local rights it is the general tendency to harmonize the difference through Congressional action, for which there is ample though somewhat ill-defined authority in the Constitution." . . .

The Constitution is not to be quite so liberally interpreted. The tenth amendment specifically excludes powers which are "ill-defined"; if they are not plainly and clearly granted, they do not exist.

The truth is that the states have dumped upon the federal government functions which do not belong to it and which they themselves should perform at the expense of their own citizens; yet, that self-government has been mismanaged is not a reason for taking it away. The distribution of general powers to the United States, local powers to the states and the reservation of powers, not granted to either, in the people can only be changed by amending the Constitution. It is on the whole the best that the wit of man has yet devised.

There are so many plainly granted powers which the Congress has not seen fit to exercise that it seems a pity for it to go out of its way to strain after more not granted. For example, it might, as it has been given power to do, "fix the standard of weights and measures" which we have all so long and so earnestly urged upon it, and might punish the scandalous misbehavior such as is now attracting attention in New York of using false weights and false measures; and it might provide for an adequate inspection all through the country so that there might not be six "bushels," four "gallons," ten "casks" and several "barrels" of different sizes in different parts of the country—even if it did not go so far as we all wish it would, and adopt the metric system *in toto*.

New York. T. J. JOHNSTON.

[We cannot, of course, venture into argument with our accomplished legal correspondent on the points of law involved in the interpretation of the Constitution of the United States. We may, however, be permitted to disagree with him on the point that there can be no controversy on matters "which have been definitely closed to all discussion by decisions of the Supreme Court of the United States." Decisions wise in their day may, in the course of social evolution and industrial development, become anachronistic; and a later generation will not be withheld from discussing the application of such decisions to changed conditions. Not being divinely inspired the founders of the Constitution could not in 1787—many years before the discoveries of Volta and Faraday upon which a great branch of modern industry is founded—provide for the future, when the energy of water-powers would be distributed by means of electricity even hundreds of miles from the point of hydraulic development, thereby giving to such water-powers an importance, socially and industrially, undreamed of a century ago. Moreover, the existence of a state line cannot, in accordance with modern ideas of right and wrong, be held as a justification for the destruction of a property right having no relation to state boundaries, as in the case cited; and we do not believe that the spirit of the Constitution involves the commission of a wrong in order to uphold a doctrine of strict interpretation regardless of human advance through ages.—ED.]

Analytical Investigation of an Impedance Paradox.

To the Editor of Electrical World:

SIR:—In an article in the Aug. 11, 1910, issue of the *Electrical World*, on page 329, entitled "An Impedance Paradox," is given an interesting graphical analysis of an unexpected increase in impedance obtained, in a circuit composed of a resistance and reactance in series, by shunting a second resistance across the reactance.

The following is an analytical investigation of the same circuit which leads to a more general conclusion:

Let R be a fixed resistance, x a fixed reactance, r a variable resistance, g the conductance and b the susceptance of circuit BC.

Then $g = \frac{1}{r}$ and $b = \frac{1}{x}$ as r and x are assumed to be ideally pure resistance and reactance respectively.

The admittance, Y, of circuit BC is

$$Y_{BC} = \sqrt{\frac{1}{r^2} + \frac{1}{x^2}}$$

The resistance of circuit BC is

$$r_{BC} = \frac{g}{Y^2} = \frac{rx^2}{r^2 + x^2}$$

The reactance of circuit BC is

$$x_{BC} = \frac{b}{Y^2} = \frac{r^2 x}{r^2 + x^2}$$

The total resistance of circuit AC is

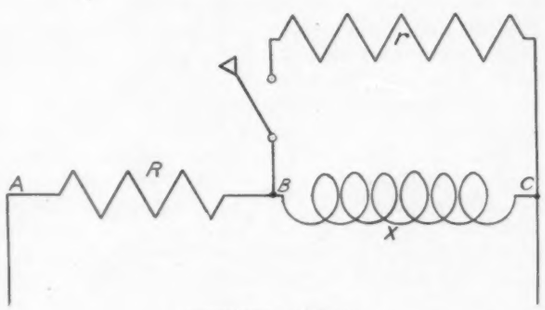
$$r_{AC} = R + r_{BC} = R + \frac{rx^2}{r^2 + x^2}$$

The total reactance of circuit AC is

$$x_{AC} = x_{BC}$$

Therefore the total impedance of circuit AC is

$$Z = \sqrt{\left(R + \frac{rx^2}{r^2 + x^2}\right)^2 + \left(\frac{r^2 x}{r^2 + x^2}\right)^2} \qquad (1)$$



Impedance Circuit.

which is the equation of the curve shown in Fig. 4 of the original article with z and r as the variables.

Differentiating and simplifying gives

$$\frac{dz}{dr} = \frac{Rx^3 + x^3 r - Rr^2}{(r^2 + x^2)^2 \sqrt{\left(R + \frac{rx^2}{r^2 + x^2}\right)^2 + \left(\frac{r^2 x}{r^2 + x^2}\right)}}$$

Then, placing the numerator equal to zero,

$$r^2 - \frac{x^2}{R} r - x^2 = 0$$

and

$$r = \frac{\frac{x^2}{R} \pm \sqrt{\frac{x^4}{R^2} + 4x^2}}{2} \qquad (2)$$

This equation gives the critical value for r, which, when substituted in equation (1), gives to Z a maximum value or a minimum value. (The value $r = \infty$ will also make $\frac{dz}{dr} = 0$, but this value merely indicates that the asymptote of the curve is parallel to the r axis.)

As the original function and the second derivative are quite cumbersome, an examination is made below of the first deriva-

tive to determine the nature of the critical point in the curve. As only the signs are of interest, the denominator of the first derivative, which is positive for any value of r, may be disregarded.

Then $$f(r) = Rx^2 + x^2r - Rr^2 \qquad (3)$$

Let a be a very small quantity which may be taken as small as may be desired, but not equal to zero.

Substituting in (3) values of r: r_1, a little less than the critical value; r_2, equal to the critical value; r_3, a little greater than the critical value, gives, after simplifying,

$$f(r)_{r_1} = a\,[\sqrt{x^4 + 4x^2R^2} - aR]$$

which is a positive value, because the expression under the radical is greater than $2xR$ and a is as small as desired; that is, it is less than $2x$.

$$f(r)_{r_2} = 0$$

and

$$f(r)_{r_3} = -a\,[\sqrt{x^4 + 4x^2R^2} + aR]$$

a negative value.

Therefore, the value of Z is a maximum when (r) equals the value given in equation (2), for the tangent has been shown to change from positive to negative, and to pass through zero.

One is permitted to conclude, therefore, that, by making r equal to the value given by equation (2), the phenomenon of increase in impedance upon shunting a resistance across the reactance can be obtained for any finite value of R or x, no matter how small or how large.

Numerical Calculation.—The value for the maximum impedance is here calculated for the same values as given in the original article.

$R = 100$ ohms, $x = 133.8$ ohms.

At Z_{max}

$$r = \frac{\frac{17900}{100} + \sqrt{\frac{3204 \times 10^5}{10^2} + 71600}}{2} = 250.5 \text{ ohms}$$

$$Z_{max} = \sqrt{\left(100 + \frac{250.5 \times 17900}{62700 + 17900}\right)^2 + \frac{62700 \times 133.8}{62700 + 17900}} = 187.4 \text{ ohms},$$

which is the same as the maximum point on the curve in the former article. The values here recorded were calculated by means of a slide rule and are therefore only approximately correct.

Jersey City, N. J. H. F. Hagen.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Control of Three-Phase Motors.—F. J. Moffett and N. B. Rosher.—The authors first discuss time-lag attachments to circuit breakers for use in connection with three-phase motors and then describe a new slow-motion device for starters as shown in Fig. 1. Each operation of the starting-switch handle

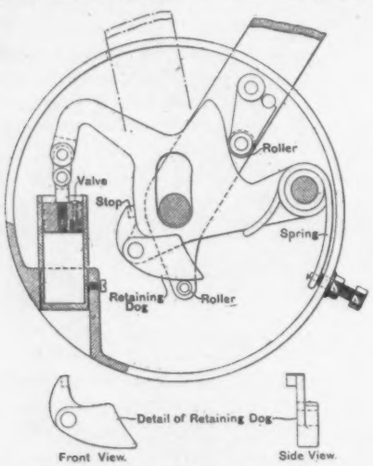


Fig. 1—Slow Motion for Starter.

rocks a lever, and thus causes the plunger of a dash-pot to be depressed. Until the plunger has been forced back to its normal position by means of a spring further operation of the switch handle is impossible, since a stop, or retaining dog, has been moved into its path. The interval between successive movements of the handle can be regulated within wide limits by adjusting the air vent in the plunger or the strength of the spring which acts upon the same. As a general rule starting switches are provided with too large a number of steps or contacts, the necessity for these arising out of the desire to provide for a gradual rising of the voltage applied and the avoidance of current rushes. With the mechanism above described the need for a large number of steps disappears, since a sufficient pause is enforced on each step to enable the motor speed to attain the value corresponding to that step. The advantages of this device are specially evident when it is applied to a two-position switch, such as the star-delta or auto-transformer, where a prolonged pause on the intermediate position is an absolute necessity.—Lond. *Elec. Eng'ing,* Sept. 22.

Transformers.—E. F. Collins.—A continuation of his long serial on commercial electric testing. The author continues the discussion of transformer tests, dealing especially with core loss and exciting current, parallel test, normal load heat run, overload heat runs, insulation tests, and high-potential tests.—*Gen. Elec. Review,* October.

Voltage Drop of Transformers.—K. Faye-Hansen.—A translation of his recent German article in which the author discusses the testing of transformers for voltage drop and emphasizes the desirability of using Bragstad's method for this purpose. A number of test results are given for transformers having high reactance.—Lond. *Electrician,* Sept. 23.

Lamps and Lighting.

Electricity versus Gas for Street Lighting.—An editorial pointing out that according to the figures of the gas people it would seem that some of the recent contracts made by British gas companies for street lighting show the tendency to carry on street lighting by gas in these cases for the sake of advertisement and at a figure which is unremunerative. While they have a right to do so they have no right to claim, as a result of these contracts, that street lighting by gas is cheaper than by electricity. It is pointed out that in various British cities gas lamps are now being replaced by electric lamps.—Lond. *Electrician,* Sept. 23.

Metallic-Filament Lamps in English Practice.—A review, based on statements of various British central-station managers, of the use of metallic-filament lamps for lighting streets, railway yards, etc. Comparisons are made with gas. For instance, at Harrowgate the cost of gas from the gas company to the city, including everything except labor, cleaning and lighting, is $4.25 per lamp per year, and the lights are extinguished about 12:30 a. m. The electricity department has, nevertheless, received instructions to change 500 gas lamps to electricity. They will be able to provide a better light, furnished by means of metallic-filament lamps, at an actual cost to the city of $2.80, including lamp renewals and everything except cleaning and lighting, or a reduction on the former price of one-third. There will be some saving also in the cleaning, as electric light does not coat the glass with a smoky film as does gas; furthermore, in most of the lanterns there will be no glazing, excepting in the nature of a reflector over the lamp

itself. The city is paying to the electricity department $4.25 per year, the same price as to the gas company excepting that the $4.25 per post for electric lighting includes lamp renewals, and the difference in the actual cost and the amount received will pay for the cost of the conversion in a very few years. The 500 new electric lamps referred to are to be located in positions where there are already low-pressure electric mains. The experience of Christie in Brighton with the leading makes of these lamps is that they are steadily improving, both as regards efficiency and life, and in many cases individual lamps are actually burning for upward of 5000 hours without any apparent diminution in the candle-power. The average life of the best makes of these lamps, however, is, he considers, not as good as it might be, and he thinks the low consumption of a little over 1 watt per candle might be sacrificed to a small extent with advantage both to the lamp-making industry and to the user if a longer life could be assured. Christie considers few users would object to 1.5 watts per candle as a standard, and the extra 0.3 watt or 0.4 watt would give the makers a wider margin to work on, which, in time, should tend to reduce the cost of manufacture. A. Dimmack gives data on the life of metallic-filament lamps in Swindon. Since March, 1908, the following is a record of lamps that have failed: Between 0 hour and 110 hours, 27 lamps; between 100 hours and 200 hours, 23 lamps; between 200 hours and 500 hours, 61 lamps; between 500 hours and 1000 hours, 59 lamps; between 1000 hours and 2000 hours, 76 lamps; between 2000 hours and 3000 hours, 62 lamps; between 3000 hours and 5000 hours, 45 lamps. Many lamps have burnt over 5000 hours and are still burning. The average life of the lamps has been 1534 hours. Notes are added on the use of metallic-filament lamps for lighting railway stations, railway yards, etc.—Lond. *Electrician*, Sept. 23.

Metallic-Filament Lamps.—Some notes on the production of metallic-filament lamps by British manufacturers. Osram lamps can now be had in all sizes from 0.5 cp to 1000 cp. The 400-cp, 600-cp and 1000-cp lamps have taken the place of small arc lamps in many instances. Tantalum lamps are now being made in all candle-powers from 5 to 50 and for all voltages between 20 and 250. They are made in several different types, including candle, tubular and focus lamps. The "onewatt" tantalum lamp, besides being specially designed for use with batteries—that is, for burning on voltages from 4 volts to 8 volts and in candle-powers from 3 to 6, is made in moderate sizes of 10 cp and 16 cp, and in the large size of 100 cp. Some notes are added on the drawn-tungsten-filament lamp of the British Thomson-Houston Company, and several other tungsten lamps.—Lond. *Electrician*, Sept. 23.

Long-Burning Flame-Arc Lamp.—An illustrated description of a new flame-arc lamp giving from 80 to 100 burning hours with one pair of electrodes, placed on the market by a British company. The principle adopted in this lamp to secure long-burning periods is the total enclosure of the arc. The difficulty, however, that has to be overcome is satisfactorily to dispose of the fumes resulting from the arc, which, owing to enclosure of the latter, cannot be disposed of by ordinary methods of ventilation. This is effected by novel arrangement of the globe and burning chamber. The globe is divided into two parts as shown in Fig. 2. The upper portion is clear, to allow of the light being distributed. The lower portion is opaque, as clear glass would serve no useful purpose. The appearance is also better. Naturally this lower portion is cooler than the upper, which is heated by the arc. Consequently, all the heavy ash sinks to the bottom. Above the arc itself a heavy deposition chamber is arranged, which, owing to its large radiation surface, causes all the lighter gases to condense inside it. A constant circulation is thus set up, and the ash or deposit is so completely got rid of that the loss of light through the clear portion after 100 hours of burning is insignificant. The mechanism in the direct-current lamp is of the differential pattern, while in the alternating-current lamp it is of the motor type. The arc e.m.f. is about 45, so that two lamps can be used on 110 volts, four on 220 volts and five on 250 volts. It is recommended that a series of over two lamps should be fitted with automatic safety devices. The curve in Fig. 3 shows how the light is distributed. The maximum is at an angle of 20 deg. below the horizontal, so that the lamps need not be hung so high as an ordinary flame arc with converging electrodes. Thus the cost of poles and installation is reduced. The power-factor of the alternating-current lamp is 0.86, and the mean hemispherical candle-power in Hefner candles is 800

Fig. 2—External View of Flame Lamp.

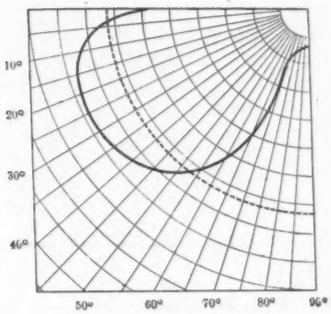


Fig. 3—Distribution of Light from Flame Lamp.

for the 8-amp lamp and 1500 for the 12-amp lamp. The practical specific power consumption is of the order of 0.33 watt to 0.36 watt per candle.—Supplement to Lond. *Electrician*, Sept. 23.

Long-Burning Flame-Arc Lamp.—W. Hechler.—In order to construct a flame-arc lamp with long-burning hours the principle of the enclosed arc may be employed, but it is then necessary to provide means for removing the chemical vapors and condense them in a separate condensing space so that they will not condense on the globe and diminish the candle-power. The gradual development of lamps based on this principle is shown in various diagrams and finally a description is given of a new long-burning arc lamp of the Allgem. Elek. Ges. which seems to be identical with the British lamp described in the preceding abstract. *Elek. Zeit.*, Sept. 22.

Flame-Arc Lamp.—A note on a recent British patent (19,387, Sept. 15, 1910) of S. C. Mount and Beck Flame Lamp, Ltd., describing mechanism for multiple-electrode lamps, to move the swinging electrode of the second pair of electrodes nearer its fellow electrode than is the case with the other pair when the first pair is consumed, so that the arc is struck between the fresh pair. For several pairs of electrodes the mechanism is arranged so that only one pair is brought together each time the striking mechanism is operated.—Lond. *Elec. Eng'ing*, Sept. 22.

Electric Arc in an Atmosphere of Low Pressure.—H. Buisson and C. Fabry.—Electric arcs between electrodes of a metal which is difficult to volatilize, like iron, are in general unstable when the pressure of the atmosphere is reduced. However, they can be made stable by covering the surface of the negative electrode with a layer of oxide. For this purpose the arc may be started in air and the vacuum may be produced later. The same observation was made with nickel and copper electrodes. The relation between current, distance of electrodes, atmospheric pressure, and potential difference was studied for gradually decreasing atmospheric pressure.—*L'Industrie Elec.*, Sept. 10.

Mercury-Vapor Lamp.—J. Pole.—An illustrated description of two new automatic forms of Cooper Hewitt mercury-vapor lamps receiving energy from alternating-current circuits by means of mercury-vapor rectifiers.—*Elek. Zeit.*, Sept. 15.

International Candle-Power.—In a report of the German Reichsanstalt it is stated that the endeavor of the United States, Great Britain and France to introduce a new "international

candle" = 1.11 hefner candles, could not be supported at once by Germany, since the definition of the new unit is not free from objections. The Germans, therefore, protest against the name "international candle." However, they acknowledge that an accurately defined international unit of candle-power is the goal to strive at.—*Elek. Zeit.*, Sept. 22.

Generation, Transmission and Distribution.

British Central Stations.—A list of 119 British central stations giving details of the history, equipment, rates, etc.—Supplement to Lond. *Electrician*, Sept. 23.

Traction.

Single-Phase Traction in Switzerland.—A note on the new single-phase railway connecting Orsières with the Swiss State Railway system at Martigny (Canton Valais) which was opened to public service last month. The railway has been constructed for the Cie. du Chemin de fer Martigny-Orsières, in connection with the British Aluminum Company's water-power works now under construction at Orsières, but may become of considerable national importance, as it may form the first section of a suggested new line connecting Switzerland with Italy. The length of the line is about 20 km (12 miles). The trolley-wire supplies single-phase energy to trains at 8000 volts, 15 cycles, and consists of an 8-mm wire with simple suspension, except in the stations, where catenary suspension is employed. Each passenger motor-coach is fitted with four 80-hp, single-phase motors of the Brown-Boveri type, in which regulation is effected by altering the position of the brushes on the commutator. The weight of a complete motor-coach is 45 tons.—Lond. *Elec. Eng'ing*, Sept. 22.

Car Meters.—Abstracts of two papers read before the Tramway and Light Railway Congress in Brussels on checking the energy consumption of tramways by means of meters on the cars. One of these, by Battes, general manager of the Frankfort municipal tramways, contains a résumé of the opinions expressed at previous congresses, when Otto, of the Berlin street railways, and the author himself both spoke from experience of the advantages to be obtained and favored the use of simple hour meters as cheaper than watt-hour meters and sufficiently accurate. M. Bouton, of the East Paris Tramways, however, advised the use of amp-hour meters. A considerable amount of information has now been obtained, and a digest of the experience at different towns in Continental Europe is given in the report. Of some thirty-four cases where particulars are given the largest total saving is that of the Berlin company, all of whose cars (1491) have been fitted with hour meters at a cost of $10 each, and a total saving due to their use of $106,720 per annum, or 7.8 per cent, is reported. At Cologne, where all the cars are also equipped with hour meters, a saving of 8.6 per cent is given, and at Dresden the figure is as high as 10.95 per cent. The highest figure given is for Magdeburg, where only 42 out of 130 have meters, but a saving of 19 per cent is recorded. All the cars are equipped with meters also at several other towns, and savings varying from 1.25 per cent to 15 per cent are reported where figures are available. Other companies are still experimenting, and only three cases are mentioned where car meters have been discontinued. In eleven cases out of the thirty-four of which particulars are given, hour meters are used, in three cases amp-hour meters are preferred, while the remainder use watt-hour meters. In some cases it is reported that the use of car meters made is possible to provide accelerated service, and the Cologne tramways declare that the use of meters has led to a decrease in the number of accidents. The other report is by Bouton, general manager of the East Paris Tramways Company, who compares the advantages of watt-hour, amp-hour and hour meters. He considers most of the watt-hour meters too delicate and liable to become inaccurate, and prefers a simple form of amp-hour meter. He does not think that the hour meter gives sufficient information. Various methods of rewarding drivers whose meters show economy are suggested.—Lond. *Elec. Eng'ing*, Sept. 22.

Installations, Systems and Appliances.

Tariffs and Metallic-Filament Lamps.—A note stating that the Metropolitan Electric Supply Company, of London, has decided to raise the price of electrical energy, supplied on the flat rate, from 11 cents to 12 cents, on account of the reduced specific power consumption by metallic-filament lamps. The company offers, however, as an alternative a "telephone tariff" according to which in addition to a fixed annual charge payable in quarterly instalments, a predetermined number of kw-hours, depending on the installation, is to be charged at 4 cents per unit, and all additional kw-hours will then be charged at 2 cents.—Lond. *Electrician*, Sept. 23.

Electricity Supply in Paris.—A note on two new generating stations which are to be constructed, one in the north and the other in the south of Paris, in connection with the new energy supply scheme which was formulated some time ago. Each generator set will consist of a steam turbine, with surface condenser, directly coupled to a two-phase alternator supplying energy at 12,300 volts, and a frequency of 41.66. The output of these sets will be 10,000 kw. There will also be two continuous-current generators mounted on the same shaft as the alternator, the purpose of these generators being to supply energy to the condenser motors and for excitation purposes respectively. Each turbo-generator will be capable of taking a load of 12,500 kw for two hours after having run fully loaded, and a load of 15,000 kw for half an hour directly after the smaller overload.—Lond. *Electrician*, Sept. 23.

Dangerous Rise of Voltage.—G. Giles and M. Wohlleben.—The first part of a paper in which the authors reply at great length to the recent criticisms of Schrottke. They maintain the position that if discharges of atmospheric electricity are high-frequency discharges protective apparatus with air-gaps are useless. Several results from practice are given where horn lightning arresters had proven unsatisfactory and had been replaced by condensers with good success. The authors then take up the discussion of resonance phenomena. The paper is to be concluded.—*Elek. Zeit.*, Sept. 22.

Wires, Wiring and Conduits.

Mains Extensions in Great Britain.—In the counties of Northumberland and Durham some important extensions of the network of two power companies have recently been carried out. Upon the route from Holywell to Seghill a 12,000-volt feeder has recently been erected in order to duplicate the existing supply. The normal span between the poles on this feeder is 80 yd., each pole carrying three conductors, each of 0.05 sq. in., the conductors being of copper. For roads and railways catenary guarding has been adopted, while lace guarding is used for footpaths. The feeders commence by a junction with the underground cable near the Holywell Colliery, and a three-cored lead-covered pilot cable is also carried along the route. A pole line has also been erected from the Rising Sun pit to Backworth in the County of Northumberland, in connection with the same mains system. A 12,000-volt feeder will also be run from the Newsham switchhouse to Seaton Delaval, a distance of 3.5 miles. The line is of the same dimensions as the one mentioned above, and also carries lead-covered pilot and telephone cables slung from the catenaries. Another important extension which is in prospect and has just been placed on order is a new 20,000-volt pole line from Carville power station to Burradon. This line is of three-phase supply with 0.1 sq. in. copper conductors, a pole line joining the underground cable at a point just outside Wallsend. The purpose of this pole line is to duplicate the existing supply.—Lond. *Electrician*, Sept. 23.

Electrophysics and Magnetism.

Ionization by Alpha Rays.—F. E. Wheelock.—An account of an experimental investigation the results of which are summed up as follows: For a gas ionized by alpha rays the ions are formed in columns along the trajectory of the alpha particle. These columns are not broken up by a field applied along the axes of the columns, and the positive and negative ions have to pass each other in going to the plates of the ionization chamber, while a field at right angles to the columns produces a separation of the positive and negative ions by breaking each column up into two. With the parallel field the ionization is proportional to the intensity of the source, even when far from

saturation. The equation obtained by assuming columnar ionization with the ions uniformly distributed within the columns does not represent the curve experimentally obtained with the parallel field. The experimental curve lies below the calculated curve, except for small potential gradients, when the ordinary Bragg chamber is used. The lack of agreement between the experimental and calculated results is not due to an inclination of some of the columns in the ionization chamber. The lack of saturation obtained at different parts of the range, when the field is applied parallel to the path of the ionizing alpha particle, is not completely accounted for by initial recombination; neither does columnar ionization completely explain the results obtained with the perpendicular field. The saturation value of the current is obtained more easily as the pressure of the gas is diminished. This would be expected in either hypothesis. However, the results obtained appear to indicate that the lack of saturation is not all due to the effect of general recombination of the ions within the columns. Undoubtedly a considerable part of the anomalous behavior of the ions produced by alpha rays (in respect to saturation, etc.) is due to the columnar arrangement of the ions; it is possible that this would be sufficient to account for all the facts if the distribution of the ions within the columns were known. On the other hand, it appears probable that certain outstanding discrepancies may be due to initial recombination.—*Amer. Jour. of Science*, October.

A Magnetic Field Moving through Space.—W. F. G. Swann.—A paper read before the British Association on the magnetic field produced by a charged condenser moving through space, in which the author raised the old controversy of the motion of ether through space. He explained that as it is impossible to detect magnetic flux with the aid of a compass he tried detection by means of a moving coil. He showed that in the case of a closed circuit (a coil) at constant potential moving through space in company with a system of charged bodies the total magnetic flux through the circuit is zero. When, however, the space within the coil is partially filled with a dielectric then a magnetic flux through the coil should exist, provided the specific inductive capacity could be looked upon as an absolutely continuous quantity throughout the dielectric; but if the dielectric action is to be explained entirely by the presence of electric charges or doublets no resultant flux should be observed even in this case. His apparatus gave practically no flux, and he hence regarded his experiments as supporting the doublet theory of dielectric action. In his experiments two coils, wound in opposite directions, were mounted on the same horizontal axle and rotated between three parallel condenser plates, such that coil 1 was between plates 1 and 2, and coil 2 between plates 2 and 3; the opposite winding would eliminate the earth's field. The coils were partly embedded in paraffine; condenser plate 2 was charged, and the other two were earthed; after discharging the condenser the apparatus was turned through 180 deg. In the discussion which followed Sir J. J. Thomson considered the paper very important, but did not see how, in the absence of any relative motion between condenser and dielectric, any effect should be expected. Prof. A. W. Conway thought that an effect might be anticipated, and not completely be masked, because the electrons were supposed to move freely in a conductor, but not in a dielectric; if Sir J. J. Thomson were of the opposite opinion he seemed to believe in the principle of relativity.—Lond. *Eng'ing*, Sept. 23.

Units, Measurements and Instruments.

Resistance Standards.—In the calorimetric researches of the German Reichsanstalt the problem came up to devise an easily and exactly reproducible empirical temperature scale. For this purpose mercury-resistance thermometers were devised as shown in Fig. 4. The mercury is enclosed in W-formed capillary quartz tubes *a* the ends of which communicate with additional quartz tubes *b* which contain the electrodes *c* consisting of pairs of platinum wires in glass tubes. The whole apparatus is enclosed air-tight. The two wires on each side are used as ammeter and voltmeter connections. Two such mercury-resistance thermometers made of quartz agree together at any temperature between 0 deg. C. and 100 deg. C. to even a few thousands of a degree. Such a result cannot be obtained with mercury elongation thermometers. These mercury resistors seem to have a very constant resistance and two of them may be used as secondary ohm standards.—*Elek. Zeit.*, Sept. 22.

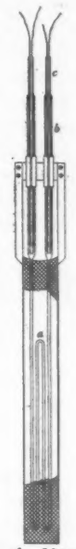


Fig. 4—Mercury Resistance Thermometer.

Weston Cell.—In continued experiments in the Reichsanstalt it was found that mercurous sulphate may give cells of normal e.m.f. when used right after being prepared, but may change in its electrometer behavior if stored for several months in a dry place. It was further found that storing of the fresh mercurous sulphate in vacuo or below a cadium sulphate solution prevented these changes. It is believed that now the last trouble in the use of mercurous sulphate has been overcome.—*Elek. Zeit.*, Sept. 22.

Photographic Recording Meter.—L. M. Aspinwall.—In making tests on electric locomotives and cars it is necessary to have a complete set of current, voltage, power and speed readings in order to determine accurately the performance of the equipments. The necessary readings are usually obtained by having a number of observers on the locomotive to read portable instruments simultaneously at equal predetermined time intervals. To obviate the necessity of having a number of observers the use of the kinetoscope type of camera which would photograph a number of indicating instruments at the rate of one or more exposures per second has been suggested at various times. The author has developed another method which is based on the following principle: If edgewise indicating instruments—that is, instruments with the pointers moving in a vertical plane—are used with a black scale and white divisions and pointer, they can be photographed on a film moving at a constant rate of speed at right angles to the meter, and the white divisions will trace horizontal co-ordinates and the white pointer will trace a continuous curve, thus giving a finished record at one operation. Some details of the camera used are given with reproductions of curves obtained by this method.—*Elec. Journal*, October.

Vacuum Bolometer.—In an investigation of the radiation loss made at the Reichsanstalt use was made of a vacuum bolometer in which the intensity of radiation was measured not by galvanometer deflections, but by a zero method as shown in Fig. 5.

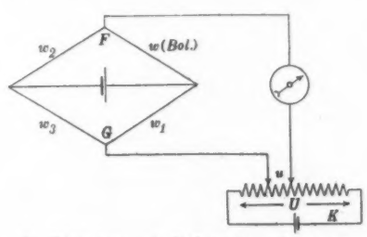


Fig. 5—Diagram of Bolometer Arrangement.

The radiation falls on the bolometer resistance *w*. The voltage thereby produced between *F* and *G* is compensated by regulation of the resistance *U*. Nothing is required but the constancy of the source of current in *K*.—*Elek. Zeit.*, Sept. 22.

Registration of Thunderstorms.—P. Jegou.—An account of experiments in which the author used an electrolytic wave-detector in connection with an ordinary galvanometer and photographic recorder for registering atmospheric discharges and thunderstorms. When a telephone is placed in series with the electrolytic detector and galvanometer it is possible to listen with the ear to the discharges or to the thunderstorm without

any effect on the photographic record.—*La Lumière Elec.*, Sept. 24.

Reichsanstalt.—An abstract of the annual report on the work done in the German Reichsanstalt in 1909. Some of the chief results obtained are given in other abstracts in the Digest.—*Elek. Zeit.*, Sept. 22.

Telegraphy, Telephony and Signals.

Submarine Telephone Cable.—A note on a recent British patent (26,250, Sept. 15, 1910) of Siemens Brothers & Company, Ltd., and W. Dieselhorst. The Pupin or inductance coils of submarine telephone cables are wound with more or less hydroscopic material, and to prevent moisture being gradually absorbed by this the coils are provided with a light sheathing of impermeable material, such as tin or leadfoil. This sheath may be placed between the coil itself and the gutta-percha protecting tube.—Lond. *Elec. Eng'ing*, Sept. 22.

Wireless Telegraphy.—W. H. Eccles.—The conclusion of his illustrated article on recent patents in wireless telegraphy. A combination of wireless telegraphy and the method of submarine bells due to J. Schiessler is mentioned. Its purpose is to obtain a measurement of the distance of a ship or other station emitting both kinds of signals simultaneously. The principle employed is the simple one of measuring at the receiving station the time interval between the arrival of the Hertzian wave and of the sound wave. The suggested receiving apparatus comprises five circuits—a circuit containing a submerged microphone, a telephone relay circuit, the circuit of an electrical chronometer, a circuit comprising an electromagnet that sets a tuning fork in vibration, and the telephone circuit of a wireless receiving installation. Several new designs of antennæ are also noticed and notes on a few patents on wireless telephony are added.—Lond. *Electrician*, Sept. 9.

Miscellaneous.

Plastic Insulating Materials.—A. Hakansson.—The first part of a paper on plastic insulating materials. In many cases of failures the trouble is not with the material, but with an unsuitable design of the form of the insulator. This fact is illustrated by various examples from practice. The insulation resistance, which is the property of greatest importance, does not remain constant, but changes due to aging. Illumination seems to have a considerable effect on the insulating resistance. With traction insulators, which had been in use for eight or ten years those parts which were enclosed in cast-iron fittings had not been changed at all with respect to insulation resistances and mechanical strength, while both had considerably decreased on those parts which had been subject to light. Moreover, insulators on which dust is liable to be deposited quickly lose their insulation resistance. With high voltages aging is far more noticeable than with lower voltages. The formation of ozone seems to have some effect in this respect. To maintain the insulation resistance constant it is necessary to clean and wash the insulators at intervals in order to remove any dust, etc. The mechanical strength of insulators depends as much on their form as does the insulation resistance. The insulation resistance depends to a large extent on the absorption of moisture. Several curves are given showing the increase in time of the weight of hygroscopic insulators due to absorption of moisture. The paper is to be concluded.—*Elek. Zeit.*, Sept. 22.

Insulating Material.—A note on a recent British patent (23,351, Sept. 15, 1910) of the British Thomson-Houston Company (General Electric Company of this country). Talc or clay is mixed with a compound of titanium and a silicate binder, and the product is compressed and fired at a temperature of 900 deg. C. to 1500 deg. C. The presence of the titanium has been found to increase the strength and refractory qualities of the material.—Lond. *Elec. Eng'ing*, Sept. 22.

Röntgen Society.—An account of the proceedings of the sixth congress of the German Röntgen Society held in Berlin. Brief abstracts are given of the different papers presented, all of which are of medical interest.—*Elek. Zeit.*, Sept. 22.

Education.—Miers.—His presidential address delivered to the Educational Science Section of the British Association dealt especially with the radical difference which should exist between school and university teaching. The business of direct mental training should be finished at school and at the university material should be given the trained mind upon which to do responsible work in the spirit of inquiry. Preparatory exercises belong to school life and should be abandoned at the university. All this seems so obvious that it might appear to be hardly worth saying were it not that the methods which actually prevail are so far removed from this ideal. At school no subject should be taught to a class as though it were intended to be their life work. On the other hand at the university each subject should be studied as though it really were the life work both of teacher and student. In replying to the question what sort of school education affords the best preparatory training for the university, the author thinks that a literary education at school is at present a better intellectual training for general university work than a scientific education.—Lond. *Electrician*, Sept. 9.

Avoiding the Spark in Opening a Circuit.—S. Riefler and C. Paulus.—In electric clocks and similar instruments it is of importance to avoid the spark when the circuit of an electromagnet is opened. The author has investigated by means of an oscillograph the different methods by which the spark may be avoided. With respect to the certainty with which the spark may be avoided, condensers and ohmic resistances in parallel to the switch are equivalent, but with respect to lower cost of operation the condenser is superior to the ohmic resistance. Moreover, the condenser may always be so designed that the excess voltage on opening the circuit remains within permissible limits. Polarization cells (small storage batteries of low capacity) combine at least for low voltages the advantages of the condenser and of the ohmic resistance.—*Elek. Zeit.*, Aug. 25.

Reinforced Concrete for Chimney Construction.—P. S. Sheardown.—A paper read before the Dublin congress of the Tramways and Light Railways Association giving notes on the reinforced-concrete lining of the steel chimney shafts at Ringsend generating station of the Dublin United Tramways Company, and on reinforced concrete for chimney construction.—Lond. *Electrician*, Sept. 16.

Logarithmic Paper.—G. Meyer.—An article illustrated by diagrams on the advantages of logarithmic paper for engineering purposes, for instance, for the representation of the work of pumping, etc.—*Elek. Anz.*, Sept. 8.

Book Reviews

Funktionentafeln mit Formeln und Kurven. By Dr. E. Jahnke and Fritz Emde. Leipzig: B. G. Teubner. 176 pages, 53 illus. Price, 6 marks.

There are many books, both of pure and of applied mathematics, that contain treatises on some particular function or functions, such as elliptic functions, Bessel's functions, or the like, but this treatise sets itself the useful task of collecting into a single volume all of the principal mathematical functions for comparison and reference It is true that no very complete treatment can be given to any single function when so many have to be considered, but at least the student is given a bowing acquaintance with all of them so that after going through the list he is able to recognize and name a function at sight. The genealogy and family relations of the functions are also explained.

Among the functions discussed are the following: Complex quantities, hyperbolic functions, potential functions, Bessel functions, Fresnel integrals, gamma functions, Gauss' error integral, Pearson functions, elliptic functions, spherical harmonics, and numerous subtypes.

A few decades ago all of the above functions, so far as they were known, were the exclusive property of pure mathematicians and philosophers. Now most of these functions are

harnessed to engineering formulas for the everyday work of practical men. One of the authors of the book is an engineer. To the student of applied mathematics the volume will be a valuable reference book. It is hardly to be considered as a text-book. Numerous references to text-books appear, however, in the text.

Die Mechanische Beanspruchung Rasch Laufender Magneträder. By Ch. A. Werner. Halle: Wilhelm Knapp. 95 pages, 47 illus. Price, 4.50 marks.

The use of turbines for driving generators has greatly increased the difficulties of mechanical design of the rotating members of the generators, and in this connection Mr. Werner has produced a timely book which should be of use to designers and those engaged in teaching design. The different types of revolving-field structures are first described, then the general laws of stress in curved members and their application to the parts of a revolving-field structure are discussed. Practical examples are worked out and stress diagrams for different types of structure given.

Der Kupfermarkt unter dem Einflusse der Syndikate und Trusts. By Rudolf Lenz. Berlin: Velag für Fachliteratur. 156 pages. Price, 3 marks.

Germany being one of the greatest manufacturers of electrical machinery and other products which require copper, and being obliged to import over 80 per cent of the total amount used, feels somewhat concerned over the probable results of a complete monopoly of the copper production of the world. The author traces briefly the history of the copper industry and gives in great detail the development of the Amalgamated Copper Company and the moves of the Standard Oil Company to control the copper market. Germany's position as one of the principal consumers of copper is set forth and the effects of a complete Standard Oil monopoly discussed. However, the author sees great difficulties before the Standard Oil in bringing about such a monopoly. He points out the difference between the copper situation and the oil monopoly, showing that the oil industry is peculiarly well adapted to assist in the maintenance of a monopoly. The book contains a mass of data in tabular form showing the growth and present state of the copper industry in the different countries of the world. The author has developed his subject in a clear-cut and entertaining manner. A mass of digested statistics are presented and there is presented much food for thought.

Das Radiotelegrapkische Praktikum an der Technischen Hochschule in Darmstadt. By H. Rein. Berlin: Julius Springer. 100 pages, 89 illus. Price, 3 marks.

The present is a text book of experimental work in the study of wireless telegraphy and high-frequency phenomena and apparatus. It is intended especially for use in the Technical Institute at Darmstadt, which possesses a very complete wireless equipment. The course covers the following ground: The calibration of condensers for various kinds of service; listing of condensers and dielectrics to determine their properties; calibration of reactors; measurement of inductance of various types of apparatus; testing of oscillating transformers; calibration of wave meters and measurement of wave lengths; tests to determine the damping characteristics of circuits; testing of various types of high-frequency apparatus (generators, transformers, interrupters); calibration and testing of various types of receivers; construction of sending and receiving stations.

The work is based upon the lecture course given by Prof. K. Wirtz at Darmstadt. The course is very complete and is developed in such a way as to equip the student with full knowledge of the principles and characteristics of every type of apparatus used in the generation, transmission, reception and measurement of electromagnetic waves.

Elektro-Ingenieur Kalender. 1910. Ninth edition. By Arthur H. Hirsch and Franz Wilking. Berlin: Oscar Coblentz. 308 pages. Price, 2.50 marks.

This book might well have been called a central-station handbook, since practically the whole work is given up to the design of central-station plants, followed by a discussion of the characteristics of various classes of loads. The book is extremely condensed and yet by suitable typography the important reference items are made to stand out in such a way as to render them easy to locate. The complete design of the system, including buildings, selection of equipment, design of distribution system, etc., are covered; the method of treatment somewhat resembling specifications. Tables are used profusely. The part of the book which is devoted to the load characteristics contains much information regarding the power required to drive different machines, such as pumps, machine tools, cranes, etc. Local manufacturers contribute much of the tabular data, giving dimensions and operating data regarding their machines. This data is valuable and handy to have in such form, where the apparatus is used, but here could only be of interest in making comparisons.

Les Compteurs Électriques à Courants Continus et à Courants Alternatifs. By L. Barbillion. Paris: Gauthier-Villars. 234 pages 126 illus. Price, 3.25 francs.

The subject of central-station rates is among the most live topics of the day and new types of meters are continually being developed to provide means of practically carrying out the various complicated systems of rates. Mr. Barbillion's book shows that the rate subject is about as unsettled in France as here. The book does not go into the economics of rate making, but simply states the different methods in vogue and discusses the instruments used to measure the service.

The historical side of the subject has been omitted except for the mention of a few of the electrochemical types of meters. Modern Continental types of direct-current and alternating-current watt-hour and amp-hour meters are discussed, as well as a large number of special energy meters, such as the double-rate meter, the excess-demand meter, the prepayment meter, etc. The discussion is confined to a description of the meters, the theory of operation, directions for installing and methods of testing. The work is laid out as a course of instruction given at L'Institut Electrotechnique de Grenoble.

New Apparatus and Appliances

A 38-HOUR FLAMING ARC LAMP.

Some time ago there was introduced into the United States a flaming-arc lamp known as the "Main." This lamp, it is claimed, has been thoroughly tested by three years of service before being put on the market in this country. In this lamp the complications are minimized in order to permit the use of two sets of electrodes the consumption of which independently of one another is regulated by a simple mechanical device.

The details of the lamp are shown in Fig. 1, which indicates the exceedingly simple arrangement of sliding bars so placed that they in no way interfere with the cleaning that is periodically necessary. This illustration also shows the first set of electrodes burned down to half length, while the second set is still kept in reserve with their full length. After the first set of electrode holders reach a "stop" the automatic switching over takes place in a simple manner. This result is accomplished by a lever holding the suspension chain drum for the

second pair of electrodes being released by a pin placed just above the tube wherein the chains for the first pair of electrodes move upward. The first set of electrodes retains the

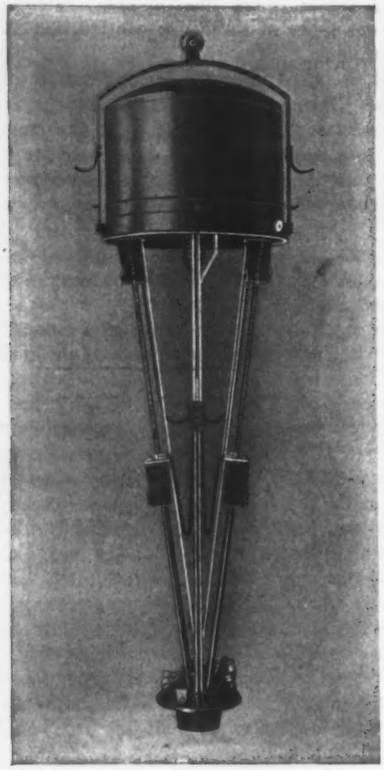


Fig. 1—Flame Arc Lamp.

arc until the rising of the arc's e.m.f. causes the second pair to move downward and form the new arc at the same instant that the first set is extinguished so that the light is never extinguished.

It is said that the gaseous materials cannot form an insulating cover on the reserve electrodes and therefore the proper and

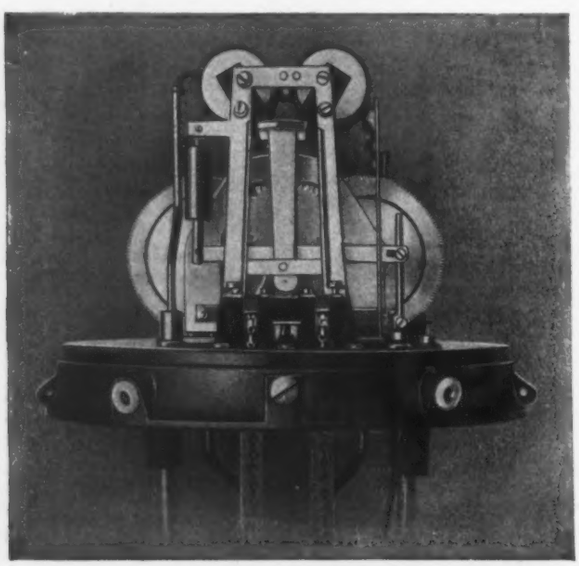


Fig. 2—Magnet System.

prompt striking of the arc is always obtained. The reserve set of electrodes is kept above the "economizer" by a gate arrangement, and is fed into the arc chamber only after the first pair is fully consumed.

It is claimed that the regulating clockwork is the simplest ever placed in any flaming-arc lamp. Fig. 2 gives a good view of the single magnet system employed, and shows also the

Fig. 3—Globes After 114 Hours' Service in Open Air.

mutual brake and regulating device for both sets of electrodes. The two large gears shown in the illustration are continually catching into one another and each one is connected to the suspension chain drum of each set of electrode holders by a sensitive locking device. The arc-deflecting magnet is arranged in a very simple way; a single device is used for both sets of

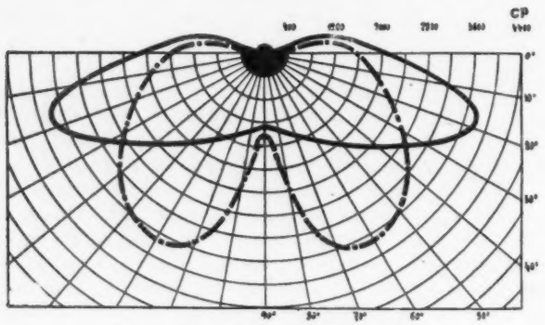


Fig. 4—Candle-Power Distribution.

electrodes, and hence the bottom plate is kept clear for viewing.

In the Main lamp use is made of a well-ventilated outer globe so as to eliminate the otherwise unavoidable fogging of the globes due to gaseous materials which would cause a loss of perhaps 30 per cent of light. The ashtray is so arranged that even in the strongest wind it will not allow the gases to pass downward, because the openings on the opposite side are automatically closed and the gases are forced to escape through the upper chamber of the lamp casing by reason of the free entrance of the outer air current. Ventilation is provided between the outer and inner globes, thereby allowing the swifter

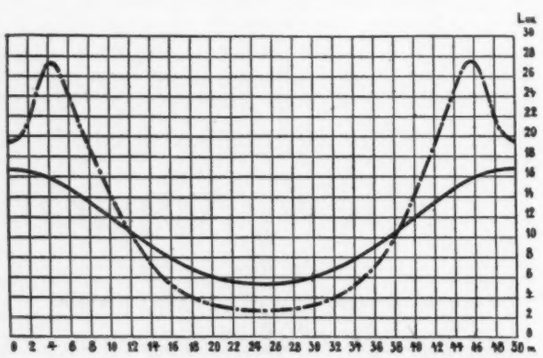


Fig. 5—Street Illumination with Two Lamps.

air currents to pass through the upper chambers without being forced into the inner globe first, and thus a uniform air circulation around the arc is maintained. The passing of air through the globe also assists greatly in the cooling of the lamp.

Fig. 3 shows the position of the inner and outer globes. It shows also the enameled reflector, which has been designed particularly for street lighting where the illumination of large areas is required, and the lamps are supported on tall masts. For local lighting the reflector is not used, a rounder and more opalescent globe being employed.

A prominent feature of the Main lamp resides in the use of an inner prismatic globe, the prisms of which have been accurately designed to throw a large part of the light in a horizontal direction. The candle-power distribution is shown in Fig. 4, while Fig. 5 indicates the illumination, in luxes, obtained in street service from two lamps placed 10 m (33 ft.) above the ground and 50 m (164 ft.) apart; in each illustration the continuous line is for the lamp with prismatic-reflector and the broken line without reflector.

The lamp operates thirty-eight hours on direct-current and thirty-five hours on alternating-current circuits with a power consumption of 550 watts when operated two in series across 110-volt circuits. For series connection at from 240 volts to 450 volts an automatic device is provided for the switching in a compensating resistance in case any of the lamps in the line for some reason should fail to work.

The above described lamp is extensively used in Germany where it has been on the market for about three years. It is used in the railroad yards at Hanan, Posen, Frankfurt, Hagen, Breslau, Hameln, Dortmund, Elberfeld and Cologne; and is employed in municipal lighting at Cassel, Barmen, München, Nürnberg and Stuttgart. The lamp is handled in this country by the Main Electric Company, Marbridge Building, New York.

SINGLE-PHASE TRACTION IN FRANCE.

One of the latest electrifications of steam railroads in France is that which the Midi Railway of France will make in connection with the Montrejeau-Pau portion of the Toulouse-Bayonne line. The portion to be electrified has a length of some 70 miles; the country is very hilly and the line has a number of gradients, one of 3½ per cent being about seven miles in length. This is the largest scale upon which electrification of existing lines has been attempted in France, and later the electrification is to be extended to the entire Toulouse-Bayonne line, a distance of 200 miles.

The Midi Railway Company has ordered from the French Westinghouse Company, whose works are at Havre, the equipments for 30 double bogie electric motor coaches for the passenger service and one complete electric locomotive for the freight service of this line. The locomotive and motor car equipments will be built entirely at the Havre works of the French Westinghouse Company, while the mechanical part of the locomotive will be built by the Italian Westinghouse Works. The design and construction is based on the results obtained in connection with the very successful electrification by the Italian Westinghouse Company of the Giovi tunnel section of the Italian State Railways on the dense traffic line between Genoa and Milan.

Each of the 30 motor coaches, each seating about 50 passengers, will be equipped with four 125-h.p. Westinghouse single-phase motors, 16 2-3 cycles, 285 volts, and with Westinghouse multiple control. These motor coaches will be able to haul trains weighing 100 metric tons—including the motor itself—at a speed of 45 miles per hour on level track. The weight of a motor coach in running order will be about 56 metric tons.

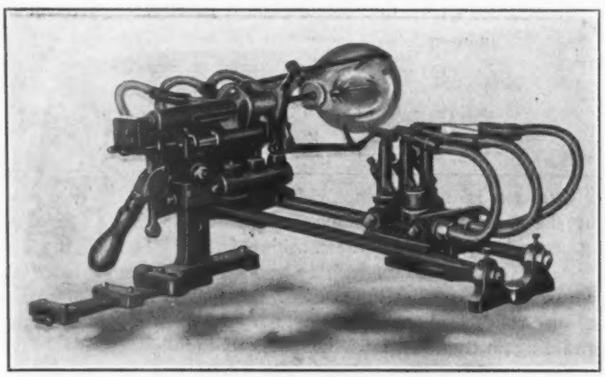
The Midi locomotive will be provided with five axles, three of which will be driven by the motors through jack shafts and connecting rods. The locomotive, which will be equipped with two 600-hp single-phase motors, will weigh 80 metric tons and will be able to haul trains weighing 400 metric tons, inclusive of the locomotive. With a haulage load of 280 metric tons the speed will be 25 miles per hour, and with 100 metric tons about 38 miles per hour.

The current will be supplied to the motors by means of a 12,000-volt overhead catenary line. The pantagraph type of trolley will be used.

SEALING-IN MACHINE FOR METALLIC-FILAMENT LAMPS.

The accompanying illustration shows a sealing-in machine which is being used in the works of the Foster Arc Lamp & Engineering Co., Ltd., London, England.

It is stated that with a few days' practice an intelligent worker can manipulate the machine, and that with it filament breakage is reduced to a minimum. As will be seen, the apparatus consists of a frame holding the bulb with forks adapted to fit any size and shape of bulb, this frame resting on and being rotated by two pulleys. One of these and the end of the shaft of the other is shown in the illustration lying horizontally above and to the right of the inclined handle. These pulleys are in turn revolved by means of an endless band passing over them and connected to a small shaft under the bench. The amount of power taken for driving is practically



Sealing-In Machine.

negligible. An important feature is that the central support of the lamp carrying the filaments is always maintained true and central.

Referring again to the illustration the inclined handle shown moves in the arc of a circle and lowers or raises the lamp in a vertical direction and also operates the gas valve fitted to the machine which automatically lowers the gas on the lamp frame being moved from the range of the gas jets. Immediately behind this handle will be seen a vertical trigger terminating in a rounded knob which is used for moving the lamp in a horizontal direction in and out of the frame, so that the position of the lamp with relation to the gas jets can be adjusted at will. The remaining portion of the apparatus is the blow pipe which is of the six-flame variety converging on practically a central point, the blow pipes being fitted with rubber tubes and glass air jets. The apparatus is stated to have been used with much success in the works mentioned above.

SECTIONALIZED HYDROELECTRIC GENERATING PLANT.

The El Tajo Mining Company, of San Sebastian, State of Jalisco, Mexico, has recently ordered a very unique sectionalized generating plant to supply energy for its new mill. The head of water available is 500 ft., and there is being supplied a special Pelton water-wheel of the two-unit type capable of developing 125 hp at this head when running at 1200 r.p.m. With this water-wheel will be supplied two pairs of jaw-clutch couplings, thus rendering it possible to disconnect either of the two generators which are driven by this wheel. The water-wheel will be sectionalized for mule-back transportation and no piece will weigh over 300 lb. A mechanical governor will be furnished to control the water-wheel.

The two generators to be driven by this wheel will be of

50-kw rating each. These also will be sectionalized in pieces not weighing over 300 lb. These generators will be three-phase, 60-cycle, 600-volt machines. They will have extended shafts for belt driving the exciters. The generating station also provides for the usual switchboard, lightning arresters and protection apparatus.

The power generated is to be consumed at the mill by various alternating-current motors, one of which belt-drives the stamp mill line shaft at a speed of 150 r.p.m., resulting in 100 drops per minute. The tube-mill line shaft runs at 200 r.p.m., the mill itself making 37 r.p.m. Other motors are scattered about the mill for the usual drives in a mill of this kind.

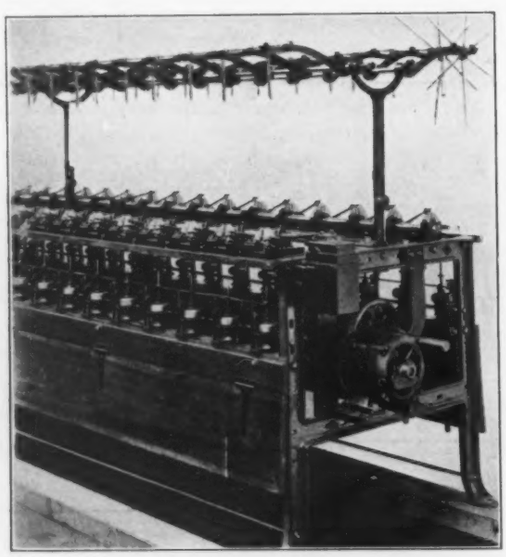
Since the generating plant is located close to the mill, the generator gives 600 volts and the motors employed are wound for 550 volts. The lighting is taken care of by separate transformers.

McKeever Brothers, of Philadelphia, are largely interested in this property. The manager of the plant is Mr. Robert H. Lilly. The equipment is being supplied by Messrs. G. & O. Braniff & Company, of Mexico, who represent the manufacturers of the machinery purchased. The electrical equipment will be supplied by the Westinghouse Electric & Manufacturing Company.

MOTOR-DRIVEN QUILL WINDER.

The forty-spindle quill winder shown by the accompanying illustration is the first motor-driven machine of its type made by the Oswald Lever Company, Philadelphia, Pa. The motor is securely fastened to the machine frame. The driving connection is through single gear reduction to the shaft of the winder. This application marks another step in the adaptation of electric motors to the silk industry and will serve to demonstrate again the inherent advantages of individual drive.

The motor has been specially designed for textile service and is designated as "textile type." It has dust-proof bearings and a dust-proof rotor; that is, no ventilating ducts are provided. In spite of the absence of all rotor ventilation, however, the distribution of material is such that the motor operates exceedingly cool. It is rated at 0.5 hp, 1140 r.p.m. for use on a three-phase, 60-cycle, 220-volt circuit. Being of the squirrel-cage induction type, the motor has no commutator, collector rings or other exposed current-carrying parts. The equipment includes an enclosed "textile-type" switch, which is operated by means of the shipper handle, thus placing its control within easy reach of the operator from any part of the machine. Both the motor and the switch were made by the Westinghouse Electric & Manufacturing Company.



Motor-Driven Quill Winder.

MOTOR-DRIVEN AND MAGNET-OPERATED CIRCUIT BREAKERS.

A good example of an installation using motor-driven circuit-breakers is found in the plant of John Wanamaker, Philadelphia. To develop the energy required for 50,000 or more electric lamps and approximately 1000 hp in motors, there were installed in the Wanamaker power plant ten direct-current generators of a total rating of 3000 kw. The circuit of each generator is controlled by a motor-operated circuit breaker placed directly alongside of the generator, as shown in Fig. 1, and controlled from a bench board located in the mezzanine gallery

The circuit breakers can be opened or closed from a distant point with ease and certainty. The instant handling of a number of generators from one central point occupying the least possible space is thus secured, care being taken that the bench board is so located as to enable the switchboard attendant to face the machinery which he is operating.

Directly behind the bench board and adjacent to it is placed the main distributing board. It receives the current supply of 15,000 amp from a single set of busbars installed under the engine-room floor and connected with the generators by means of their respective motor-operated circuit-breakers.

Such an arrangement has the advantage of keeping in service at practically all times the entire amount of copper connections between the generators and the distributing switchboard. The arrangement was designed by the Walker Electric Company, of Philadelphia, which also installed the apparatus.

The circuit breakers furnished in connection with this class of controlling apparatus are equipped with the "non-closable-on-overload" device which allows the switch member to open independently of the movement of the closing arm. Should an attempt be made to close the circuit breaker upon overload it is free to respond instantly and without restraint from the closing mechanism. Where the operator is sufficiently near the circuit breaker to have it in view the control valve may be operated by hand, but where the instrument is located at some considerable distance from the point of operation the valve may be opened electrically, suitable signals at the point

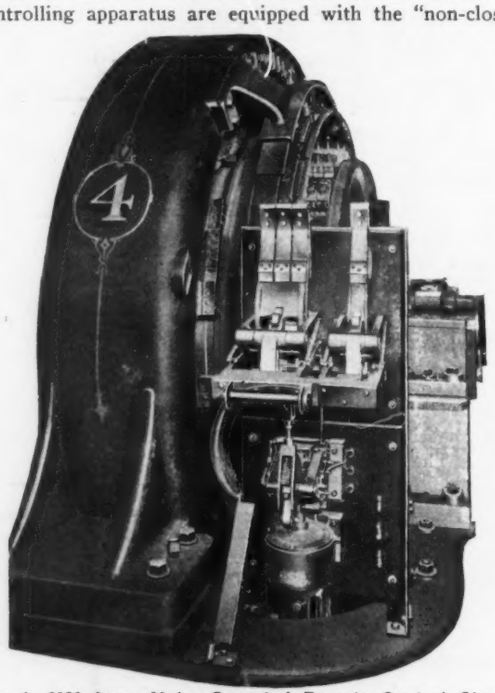


Fig. 1—6000-Amp. Motor-Operated Remote Control Circuit Breaker.

of control indicating the open or closed position of the circuit breaker. The simplicity and ruggedness of this type of apparatus render it particularly suitable for use in mills and foundries and also in those installations in which the apparatus is exposed to atmospheric changes. The above-described circuit-breakers were made by the Cutter Company, Philadelphia.

For circuit breakers of large rating either motor-operated or pneumatically operated equipments are employed, but for the small equipments the Cutter Company has standardized a complete line of solenoid or magnet-operated apparatus. A single-pole equipment of this character is shown in Fig. 2, the circuit breaker in this case being of the plain overload type. The breaker immediately opens when closed on overload or short-circuit; hence, the usual switch in series may be omitted, which provision makes for the utmost simplification in switchboard construction combined with increased flexibility of operation.

Magnet-operated circuit breakers also afford a very effective means of bringing the electrical equipment of a manufacturing plant under the immediate and complete control of the switchboard attendant. The circuit breaker may be located where economy of cable installation dictates. A twin conductor of small size running back to the main switchboard from each circuit breaker provides for signals showing whether the circuit breaker is opened or closed, thereby enabling the switchboard attendant to control it at will. This class of apparatus may also be used with advantage in street railway work for controlling from the central station the connections of outlying feeders as the necessity of traffic requires.

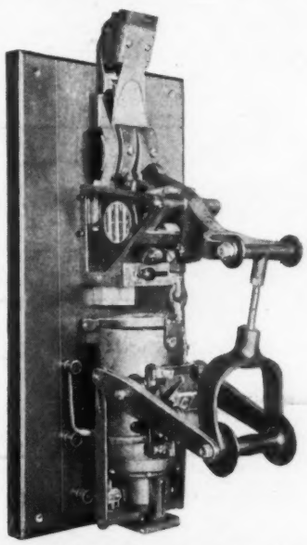


Fig. 2—Magnet-Operated Breaker.

ELECTRIC HEATING DEVICES.

The Cutler-Hammer Manufacturing Company, of Milwaukee, has established a department for the manufacture and sale of electric heating and cooking devices. The appliances include, at present, flatirons, disk stoves, curling-iron heaters, shaving mugs, portable water heaters and various types of water heaters designed to be permanently attached to water pipes. There are also several types of electric radiators, and later on a full line of electric cooking utensils will be available. The accompanying illustrations show some of these new appliances.

In the electric flatiron the heating element is so constructed that the heat is evenly distributed over the whole face of the iron. On top of the heating element and separated from it by a sheet of mica insulation is placed a thick piece of cast iron, known as the "storage plate," which serves in maintaining the even distribution of heat and also in retaining or storing the heat. This feature gives the necessary body for conserving heat, so that, like the old-fashioned hand iron, the tool will retain its heat for a considerable period of time. The energy may thus be turned on for five minutes and sufficient heat will be stored to do ten or fifteen minutes' work.

Another feature of the Cutler-Hammer iron which tends to keep the iron hot is the stand provided for it when not in use. This back-stand consists of a T-shaped bar attached to the heel of the iron. When not in use the iron is turned on end, the bar holding it clear of the ironing-board. This renders unnecessary the use of a metal stand, which tends to conduct the heat out of the iron. The back-stand may also be adjusted so as to support the iron face upward, as shown in Fig. 1, and in this position it may be used for heating water, milk, etc.

Between the storage plate and the top plate of the iron, serving to insulate the latter, is an air-gap, keeping the handle comparatively cool. A spring is used to hold the storage plate, heating element and bottom plate in close contact.

The heating element can be readily removed by the user, and an old one replaced by a new unit in case of burn-out. All irons are guaranteed for one year, however, and it is expected that they will give good service for two or three years. However there are no soldered connections, and the iron can be readily taken apart and a new heating element inserted by any one by the use of a screwdriver. The heating element consists of a special resistance wire wound on flat metal plates. The current is conducted to it through two posts projecting through the top plate. Contact tips slip over these posts.

Fig. 1—Electric Flat Iron Supported Face Uppermost.

Between these tips and the conducting cord leading to the socket there is a "ring-and-spring" connection, which is an especial feature of the iron. This attachment prevents kinking and chafing at the point where the cord is attached to the iron, which has heretofore caused considerable trouble. As clearly shown in Fig. 1, the wire itself is firmly attached to a metal ring surrounding one of the handle supports, this serving to remove all strain from the contact tips, which, except for this device, might be accidentally pulled off the contact posts. The household and laundry irons are made in three sizes, weighing 5 lb., 6 lb. and 7 lb., and there is also a special sleeve iron weighing only 4 lb., with a long, narrow body. Heavy irons for tailors, weighing up to 20 lb., and also shrinking irons are available.

The Cutler-Hammer disk stove consists of a nickel-plated disk measuring 7 in. in diameter, beneath which is a sealed chamber containing the heating element, the whole being supported several inches above the table by three legs and presenting an attractive appearance. By the use of this utensil water may be heated and eggs or cereals cooked, while many other uses will suggest themselves. Cooking may be done directly on the dining table or at the bedside of an invalid, if desired. In

households possessing a disk stove but no electric iron the disk may be used to heat ordinary flatirons.

Fig. 2 shows the electric curling-iron heater. This device is attachable to a marble or slate base and may be used on the dressing table, or, as shown in the illustration, attached to the wall. The metal casing is nickel-plated and its top plate is provided with four openings, the two outer ones being designed to hold the curling iron when not in use. The two inner openings (both of which may be used at once if necessary) lead to the heating chamber in which there is an automatic switch closing the circuit to the heating element as soon as the iron is thrust into either of the openings. On withdrawing the iron the supply of energy is automatically cut off.

An electric shaving mug, nickel-plated inside and out, is also included in this new line of heating devices.

Instantaneous water heaters form an interesting feature of the Cutler-Hammer Company's new line. Fig. 3 shows a portable buffet heater with a capacity of 3 qt., which is intended for household use, a larger size, designed for bars and restaurants, having a capacity of 1 gal. Either of these heaters will furnish hot water in less than one minute after the switch is turned. Starting cold, the first glassful of steaming water can be drawn in forty-five seconds, a second glassful can be drawn 15 seconds later, and so on until the globe is emptied. The heating element is concealed in the metallic base.

For permanent attachment to water pipes, five types of instantaneous water heaters are provided. There are the therapeutic heater, the smallest of the permanently attached water heaters; the bar heater, the lavatory heater (Fig. 4), the bath heater and the tank heater. While these heaters differ in size and in some details, the general principle of construction is the same in all. The heating element consists not of wire, but of the water in the heater itself, through which current is passed by carbon-rod electrodes varying in size and number with the capacity of the heater. These rods are enclosed in a metallic cylinder through which the water flows and are so arranged that there is an open circuit between them. Hence, when the heater circuit is switched on the heater does not become operative until water enters the heating compartment. The water itself thus bridges the open circuit between the carbon rods and is almost instantly raised to a high temperature by the passage of the electricity through it.

This arrangement has manifest advantages. Turning on the

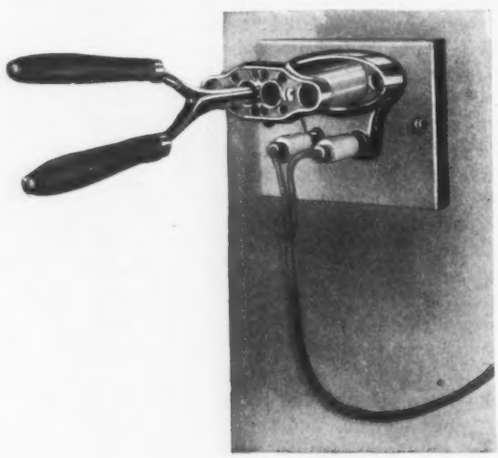


Fig. 2—Curling Iron Heater.

electrical energy produces no effect in the heater whatever. Nothing happens until the water is turned on, since the water itself forms the connecting link between the carbons, which serve as electrodes. This arrangement prevents waste of electricity, destruction of the heating elements and danger resulting from the sudden admission of cold water to a superheated cylinder.

Should one forget to turn off the electricity after drawing the hot water required, no damage will be done, since the water remaining in the cylinder will in a short time be evaporated in the form of steam, and with the disappearance of the water electricity will cease to flow even though the switch remains closed. The water itself automatically makes and breaks the circuit. The time required to obtain a continuous flow of hot water from any of these heaters is only fifteen seconds.

The type illustrated in Fig. 4 is designed for use in connec-

Fig. 3—Portable Buffet Water Heater.

tion with washbowls. It is provided with a regulating device so that the temperature of the water to be drawn from it may be varied from lukewarm to scalding hot. Where furnace heat is used to supply hot water in winter the use of this heater will be found a great convenience in the summer. All of the

Fig. 4—Lavatory Heater for Permanent Attachment to Wash Bowl.

instantaneous water heaters require a considerable consumption of electrical energy, of course.

The Cutler-Hammer Company also manufactures electric radiators designed for the heating of rooms. Three sizes are available, giving, respectively, one two and three degrees of heat. A complete line of electric culinary devices, such as chafing dishes, coffee pots, teapots and tea kettles, will soon be ready for the market.

COMPOSITE INSULATION FOR HIGH VOLTAGE.

About eighteen years ago there was developed and placed on the market a form of composite insulation possessing many unusual characteristics. Although the material was non-fireproof yet it was found to be well adapted to high-voltage work and capable of withstanding arcing without destruction. Beginning in 1902 the material was employed for high-tension

Fig. 1—Strain Insulator.

line insulators on the circuits of the Niagara Falls Power Company and the Canadian Niagara Power Company. It is claimed that although lightning has frequently caused arcs to form around the insulators not one has been damaged by lightning.

Fig. 2—Strain Insulator.

This result is attributed to the inherent flexibility of the material, which permits it to withstand heat expansion strains which would immediately rupture either glass or porcelain.

The material, which is known as "Electrose," possesses hardness and toughness without brittleness, great strength, a smooth

Fig. 3—Wall Bushing.

polished surface and is moisture, water and oil proof. It will not shrink, warp or change its form under ordinary conditions, and is suitable for use in temperatures below 200 deg. Fahr.

The insulating, puncture-resisting and mechanical characteristics of the material are shown by the following tests: A sheet 12 in. x 12 in. x ⅛ in. arced around at 75,000 volts, but

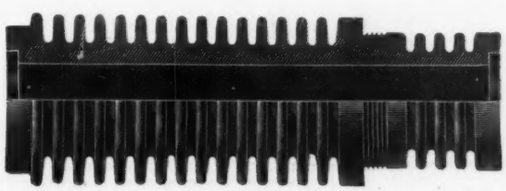


Fig. 4—Transformer Bushing.

did not puncture; a similar sheet ¼ in. thick withstood 80,000 volts without puncturing. A sheet 12 in. x 12 in. x ½ in. sustained a mechanical crushing pressure of about 10,000 lb. per square inch. A corrugated rod-type strain insulator 7 in. long by 15 in. in diameter (Fig. 1) arced over from terminal to terminal at 80,000 volts, but did not puncture; the mechanical strength was about 1500 lb. A corrugated rod-type strain insulator 18 in. long by 2 in. in diameter (Fig. 2) arced over from terminal to terminal at 175,000 volts, but did not puncture; the mechanical strength was about 3000 lb. A wall and bulkhead water-tight locking bushing 23 in. long and 4.5 in. in diameter, having a 1-in. hole extending through it (Fig. 3), arced from center of bushing to the extreme end at 90,000 volts, but did not puncture; this type of bushing has become standard with the United States Navy and practically all of the commercial wireless telegraph and telephone companies as a bulkhead bushing. Fig. 4 shows a type of wall and bulkhead locking bushing employed by the General Electric Company for oil switches and transformers of the highest commercial voltage. The electrical strength of the bushing is given any desired value by properly selecting the length.

Electrose insulation is the invention of Mr. Louis Steinberger and is made by the Electrose Manufacturing Company, Brooklyn.

CONVERTIBLE TELEPHONE SWITCHBOARD.

A type of small switchboard capable of being not only easily increased in capacity but at the same time readily converted to suit various service conditions has been placed on the market by the Western Electric Company.

The switchboard is built up of several separate units, comprising the following: Top units, line units, cord units and supporting units.

As the telephone company's requirements increase so can the switchboard capacity be increased and at all times the telephone company has a minimum investment. With the sectional unit scheme, a switchboard can not only be increased in capacity, but it also can readily be converted to any desired type.

Convertible Telephone Switchboard.

There are many hundreds of switchboards capable of giving several years of good service that are stored away because the telephone companies have no further use for them since they no longer fit in with the new order of things. Such switchboards are sometimes a bad investment because the telephone companies do not realize the full value from them. On the other hand the unit-type of switchboard should be a good investment, since, on account of its elasticity, a place of service either in whole or in part, could usually be found. It is claimed that the design of the switchboard has been carried out in a very comprehensive manner. The series includes a total of thirty different units, which should enable a telephone company to meet every legitimate condition.

ELECTRIC DISK HEATER.

In the design of the disk heater illustrated herewith special attention has been paid to the factors giving speed in starting and efficiency in operation. The use of a special under-truss has permitted the manufacturer to utilize a thin top of high thermal conductivity so that heat inertia and radiation losses are minimized. It is said that the efficiency of the design in transmitting the heat to the surface desired is about 68 per cent, and that the stove attains a temperature rise of 250 deg. during the first minute and 200 deg. during the second minute. It is claimed that the copper top is much more effective in delivering heat where wanted than is a top made of iron or other metal by reason of the high thermal conductivity of the copper.

Electric Disk Heater.

The heater described above is made by the Pelouze Electric Heater Company, Chicago, Ill.

Exhibits at the New York Electrical Show.

ELSEWHERE in this issue is an account of the opening of the New York Electrical Show, with a description of the decorative and lighting effects. The withdrawal of the electric light company exhibits from the main floor of the Madison Square Garden arena to the balcony has enabled the various exhibitors to make a better showing of their products and has served to spread the crowds over a greater area, adding much to the comfort of visitors and permitting every exhibit to be seen. Below is given in alphabetical arrangement a description of the various exhibits. The half-tone engravings show the general arrangement of the booths.

American Metal Hose Company, Waterbury, Conn., shows a sample board on which are mounted various kinds of flexible hose for steam, water and air and for electric wires. Messrs. A. Ruhin and C. Neudoerffer are present.

American Z Electric Lamp Company, New York, shows a monogram at the back of its booth studded with 18-watt tungsten lamps. As is well known, a feature of the American Z lamp is its non-blackening quality. In the booth is also shown an ultra-violet-ray sterilizer used for purifying water. Mr. M. B. Kitt is in charge.

Anderson Carriage Company, Detroit, Mich., builder of the Detroit electric, exhibits through its New York office 1911 models of a victoria and brougham. The vehicles are equipped with Edison batteries and have shown excellent results as regards mileage on a single discharge. The company has recently undertaken the manufacture of electric trucks and delivery wagons, the latter being now ready for the market. Like the pleasure cars these vehicles will be equipped with Edison batteries. Three methods of driving are standardized by the Anderson company—shaft, double chain and tandem chain. The company now manufactures sixteen models and prides itself on the finish of all its cars, attention being given to the minutest details. Those in attendance include Messrs W. C. Anderson, E. E. Higgins and Albert Weatherby.

Babcock Electric Carriage Company, Buffalo, N. Y., displays the following models: A victoria, finished in maroon; roadster, finished in primrose yellow with green stripes and leather upholstering, and a four-passenger coupé finished in Brewster green and upholstered in dark green Bedford cord. A feature of the latter vehicle is the seating arrangement whereby the customary front seat is replaced with two revolving chairs equipped with folding backs so that when not in use they can be folded up out of the way. With the chairs revolving one can face forward, backward or sidewise, allowing the operator a clear vision and view ahead. Both seats are removable and are easily lifted out of the car if not required. Three passengers can ride comfortably in the rear seat. All Babcock electrics are fitted with either the Edison battery or the standard Babcock lead batteries.

S. R. Bailey & Company, Amesbury, Mass., have on exhibition an electric victoria phaeton equipped with Edison batteries. This car has a wheel base of 82 in. with wheels and tires 34 in. x 3.5 in. and a drop frame. The battery is underhung and a wheel is used for steering. A General Electric motor is used with a continuous torque controller. The car is a duplicate of one used by Mr. Edison in making runs in and about New York City and which has just completed the 1000-mile ideal tour through the White Mountains on a gasoline car schedule. The construction of the car for exhibition purposes is improved somewhat over the other as the one on view is a 1911 model.

Baker Motor Vehicle Company, Cleveland, Ohio, has two commercial cars on exhibition. The 1000-lb. chassis is fitted with a panel side body and is built to the following specifications: Wheel base, 85 in.; tread, 56 in.; tires, 34 in. x 3 in., solid rubber front and rear; frame, pressed steel; steering gear, wheel; spring, semi-elliptic front and rear; brakes, internal expanding on rear wheels; motor, 2.5 hp series wound, 300 per cent overload capacity; battery, 42 cells, 9 P. V. Exide; transmission, Renold silent chain from motor to countershaft, oil and dustproof encased, double chain from countershaft to rear wheels, new quick detachable suspension, four bearings; bearings, ball throughout; axles, I-beam drop forged in front, forged in rear; battery suspension, cradle underslung; weight, complete chassis with battery, 2400 lb.; carrying space, length 76 in., width 42 in. and height 60 in. The 2000-lb. chassis is fitted with an express wagon body and follows the same general construction as the lighter vehicle, except that the motor and battery equipment are larger and that Timkin roller bearings are used in the front and rear wheels and annular ball bearings in the motor and countershaft.

Campbell Electric Company, Lynn, Mass., has on exhibition electromedical and central-station apparatus of its manufacture. The former comprises portable X-ray and high-frequency apparatus and a physician's outfit capable of giving all forms of current used for therapeutic work. The central-station apparatus comprises electric time switches for automatically controlling electric circuits used for flat rates, and two meter service, primary circuits to transformers in outlying districts and show-window lighting circuits. Transformers for bell-ringing circuits and for low-voltage tungsten lamps are also shown in addition to thermo flashers, etc. The electromedical apparatus is demonstrated by the J. W. Hughes Company, New York.

Columbia Phonograph Company has a number of "Dictaphones" in operation in its booth. These instruments are business phonographs driven by small motors and typists are busily engaged in writing on a typewriter what is spoken on the record. The instrument is intended for office use, for which purpose it has many advantages. Messrs. A. W. Miller, M. Smith, O. Brushaber, E. Flynn and S. Bruce explain the operation of the machines.

Conduit Machine Company, New York, is showing two types of wire fishing machines. The machine sends a snake through a conduit at the rate of 10 ft. a second and fishes and pulls wires through base plugs, wall and ceiling outlets, floor plugs and distribution boxes with equal speed. Slack is taken care of automatically and because of the continuous motion a conduit machine will fish more turns and sharp bends than can possibly be fished by hand snaking. No operation is necessary in threading the snake to the outlet box, the mechanic merely inserting the flexible shaft which contains the snake. The smaller machine shown is intended for interior wiring work, and the larger machine for underground conduit and extra heavy work. Mr. H. R. Burt is in charge of the booth.

Consolidated Telegraph & Electric Subway Company, controlling the underground electric construction work in New York City, shows an induction motor, direct-connected to an air compressor and feeding into a storage reservoir. The equipment is mounted on wheels and is used by the company in its work throughout the city, it being understood that air drills are employed very extensively in connection with underground conduit work in New York. A section of a manhole equipped with a 45-kw subway-type transformer and showing the mains and feeders as they enter and leave in conduit is on view. Cable racks, wiped joints, drainage pits, etc., serve to make the exhibit realistic, and manhole covers, sections of iron and vitrified conduit., etc., are spread about in the space allotted to the company at the rear of the Garden. Mr. E. R. Quimby is in charge of the exhibit.

Crane Company, Chicago, has a working exhibit of "Cranetilt" steam traps. For convenience in place of steam compressed air is used in a tank representing a steam boiler. A non-return trap is shown discharging water into a receiving tank; a lifting trap elevates water to a direct-return trap on top of the tank and a direct-return trap discharges water by gravity into a boiler under pressure. In addition there are a 6-in., motor-operated, cast-steel, gate valve with near as well as remote control; a 6-in. emergency butterfly valve with electric release; a 6-in. ferrosteel stop and check valve which closes automatically with drop in boiler steam pressure; a 12-in., cast-steel, flanged gate valve; a piece of pipe having a "Craneweld" flanged joint on one end and a "Cranelap" joint on the other end; numerous small brass valves of special super-heated metal, together with samples of "Klingerit" and "C. C." packing.

Fig. 1—General View of New York Electrical Show, Looking Northeast.

Cutler-Hammer Manufacturing Company exhibits for the first time its complete line of carbon instantaneous water heaters in which no wire is used at all. The line comprises bath, lavatory, bar, therapeutic and kitchen tank heaters from which hot water can be obtained in from fifteen to twenty seconds. The portable heaters on display comprise devices for buffet and bar use fitted with handsome cut-glass globes, in addition to a bar urn. There is a complete line of electric flatirons, disk stoves, curling-iron heaters, radiators, chafing dishes, coffee percolators, tea kettles, etc., on view. In the specialty line there are displayed the company's well-known push-button switches and later types of door switch, battery switch, three-point

pendant switch and a cleat switch. Mr. G. B. Katzenstein is in charge of the company's interests.

Joseph Dixon Crucible Company, Jersey City, N. J., has a line of its graphite brushes, resistance rods, crucibles, lubricants, greases, etc., on exhibition. Mr. M. A. Koerber and Messrs. Williams and Brooks represent the company.

Duntley Manufacturing Company, Chicago, Ill., has on exhibition pneumatic cleaners of various sizes to meet the requirements of homes and business houses. The cleaners are fitted with universal motors so as to be applicable to both direct-current and alternating-current circuits. The company also has on exhibition an air-washer which cleanses the air by drawing it in from outside, passing it through water and expelling it into the room. In summer the air thus treated is claimed to be from 5 deg. to 10 deg. cooler than the air in the room and in winter by the addition of a heating coil in the water the air can be tempered so as not to cause any ill effects. The cleaners manufactured by the company are too well known to require detailed description.

Economical Electric Lamp Company, New York, displays the "Hylo" and "Economical" turn-down lamps consisting of pull-string, turn-bulb and long-distance turn-down types with both carbon and tungsten filaments. Several automatic machines demonstrate the turn-down features of the lamps and instruments in the lamp circuits show the difference in energy consumption between the large and small filaments employed to obtain the two candle-power ratings. Descriptive literature illustrating all types of lamps manufactured by the company is distributed. Messrs. M. Lobenthal and L. Lobenthal are in attendance.

Edison Storage Battery Company, Orange, N. J., has an exhibition board showing all parts of the Edison battery from the raw material to the finished product. In addition there are the following batteries on view: One 5-cell battery for sparking and lighting gasoline automobiles and launches; one 5-cell battery for sparking purposes; one 25-cell battery for lighting country houses; one 25-cell battery for lighting sailing yachts; one 40-cell (225-amp-hour) battery for electric pleasure vehicles; one 60-cell (150-amp-hour) battery for 1-ton electric wagons; one tray of four 300 amp-hour cells such as are used in electric commercial vehicles and one tray of three 300 amp-hour cells, such as are used in car-lighting service on railroads. Messrs. H. L. Davisson, J. H. Gill, W. G. Bee, E. J. Ross, Jr., A. J. Doty and J. Kelly are in attendance. Mr. Walter E. Holland, who has assisted Mr. Edison during the nine years of experimental work on the battery, will also be present at various times during the show.

Edison Manufacturing Company, Orange, N. J., shows a motion-picture machine in connection with a Helios motor-generator set. Mr. Petzer is in charge of the machine, which is in operation.

Electrical Contractors' Association, of New York City, comprising some thirty-four concerns, has an exhibition panel illustrating all standard methods of wiring, such as wooden molding, open knob-and-tube, metal molding, concealed conduit, both rigid and flexible, and marine wiring. Bells, annunciators, panel boards, switches of various types, connection blocks, and other devices used in household wiring work are shown connected.

Electric Motor & Equipment Company, Newark, N. J., features its G-M lamp. This is a portable reading lamp fitted with an art-glass shade and a lower and inner prismatic glass globe for diffusing and redirecting the rays of light. In the base is a switch for regulating the intensity of the light to suit the requirements of the reader, it being understood, of course, that resistance is inserted in the circuit to reduce the potential at the lamp. The manufacturer has sought to provide a really good, library-table, reading lamp designed on scientific principles. Those in attendance are Messrs. S. H. M. Agens, E. B. Wolfe, F. Nesbit, P. A. Cooper, W. Cooke, D. Higbie, F. E. Bailey and F. Rosseter.

Electric Storage Battery Company has an immense end-cell switch arranged at the back of its booth and shows, besides sparking and vehicle batteries, insulators, connectors, spacers, etc., used in battery work and an automobile lighting outfit. Mr. R. S. Garton is in charge.

Electrical Testing Laboratories, New York, has sought in its exhibit to emphasize some of the new lines of testing which the company has developed during the past year and for which an extensive equipment has been installed. A very complete laboratory for testing paper is shown. The equipment includes not only the testing machine by which the bursting strength of paper is obtained and which is very commonly used in this country, but also German standard machines such as are employed in the Bureau of Standards in Washington and in the Royal Testing Office in Berlin. These include a Schopper machine for determining the tensile strength and extension of samples of paper and also a machine by which the paper is creased repeatedly back and forth under a uniform tension until rupture occurs. The methods of determining the composition of paper by microscopical analysis are also illustrated. There is also a laboratory for the calibration of thermometers. This includes a comparator for the ordinary sizes of chemical and industrial thermometers reading up to 100 deg. C. or 212 deg. Fahr. and another comparator using a bath of oil and serving for comparisons up to 300 deg. C. There is also a smaller comparator for testing clinical thermometers in large quantities. The baths of these comparators are heated electrically. The standard thermometers used have been calibrated at the Bureau of Standards or at the Reichsanstalt. Apparatus is also shown for testing the tensile strength of briquettes of cement. No attempt is made to show the complete outfit for the preparation as well as the testing of cement which is installed at the Electrical Testing Laboratories. In the domain of fuel testing an Atwater bomb calorimeter is shown, together with its accessories. The method in which this calorimeter is used is illustrated. Photographs illustrative of the work of the laboratories, and particularly of the large machines for testing materials of construction, are on view.

Feature Advertising Company, New York, exhibits six different types of its "Ad-o-Scope" which, as the name suggests, is an automatic machine for throwing stereopticon projections of photographs, advertising cuts, labels and trade-marks. These are reproduced in the original colors upon a small screen attached to the case containing the mechanism, and changed by an electric motor every seven seconds. A window model shows how the manufacturer may display his products, step by step, from field to table; while a theatrical model gives colored photographic transparencies of the principal scenes and portraits of the different artists, thus reproducing a play act by act and scene by scene. The special feature of this company's exhibit, however, is its new automatic stereopticon for throwing large projections on a screen erected on the roof or suspended from the sides of a building, and shown for the first time in public. Mr. W. Nephew King is in charge of the exhibit, assisted by Mr. Maximilian Klaiber.

Federal Electric Company, Chicago, Ill., exhibits its usual line of porcelain-enamel, steel, sectional letter and panel signs with some special signs. A good showing is made of Federal clusters for tungsten lamps, and fixtures for residence lighting are also on view. In addition to these well-known products of the company several items of special interest are featured. The first of these is a vacuum cleaner, a noiseless and practical machine shown and demonstrated for the first time. The Federal kitchen cabinet also makes its initial appearance. The cabinet is equipped with an electric motor and many ingenious devices for use with electricity in the kitchen. Another exhibit of special interest is the Spaulding system of ozone machinery which includes a large ozonizer and a smaller machine for use on office desks. An ozone water purifier is also shown. This device automatically treats the water when the tap is turned on and although certain types of machines

have been successfully employed for this purpose in Germany this is claimed to be the first in use in this country. Mr. Russell G. Spaulding is in personal charge of the ozone exhibit. Central-station men will be interested in the Willis "Straight Line" meter, which the company has recently placed on the market and which was described in detail in our issue of Sept. 15. This watt-hour meter has a direct-reading dial—that is, the energy consumption is registered directly in numbers and not indicated on a clock dial. Those in attendance are Messrs. J. J. Magee, G. H. S. Young and A. R. Dean.

Fox-Multax Electric Company, New York, has its booth fitted with a regulation Edison post equipped with two 100-hour flaming-arc lamps. The posts are similar to the ones erected at Churchill's and at the Kaiserhof on Broadway at Forty-ninth and Thirty-ninth streets, respectively. In addition the Fox-Watkins switch for regulating the light of lamps is demonstrated. According to the Faraday House certificate this device, which contains a resistance of patented composition in a very contracted space, saves from 12.5 per cent to 80 per cent of the energy, depending on the dimness of light desired. The 100-hour flaming arc was described in these columns last week. Messrs. J. J. Batterman, F. F. Fox and J. F. Fitzgerald are in attendance.

Fig. 2—General View of New York Electrical Show, Looking Northwest.

General Electric Company has its exhibit in the central part of the Garden. One of the most interesting features is a model kitchen furnished with a complete equipment of electrically heated cooking utensils, and a new domestic range is shown in operation. The latter resembles the ordinary gas range in construction and is provided with a commodious oven of dimensions 18 in. x 18 in. x 12 in. The three disk stoves on the top correspond to the burners of a gas range, and the range affords the same conveniences and facility in cooking that the ordinary gas range does. Some of the other heating devices on exhibition are cereal cookers, coffee percolators, chafing dishes, etc. A complete line of motors is exhibited ranging from small ones suitable for household service to those suitable for factory and mill installation. The lamp exhibit is very complete, comprising both the arc and incandescent types. An interesting feature of the latter exhibit is the new vertical electrodoe lamp, the most efficient illuminant in commercial service. The series lamp has a specific consumption of 0.178 watt and multiple type a specific consumption of 0.252 watt per mean hemispherical candle-power. This consumption is due, in a large measure, to the lower electrodes—a carbon tube with a specially prepared core—the successful result of an extensive research covering a period of years. The light from the intensified arc lamp is a near approach to daylight, and the lamp is employed principally for store lighting. The lines of this lamp are graceful and special attention has been given to the casings, which are made in Renaissance, fleur-de-lis, wreath and shield and other designs, permitting the choice of a lamp to harmonize perfectly with the store trimmings. The G.I. flame-arc lamp is also exhibited and represents the latest developments in this type of lamp. The multiple luminous-arc lamp is meeting with great favor for the illumination of mills, factories, etc., while the series luminous-arc lamp is used for street lighting. A cabinet contains different types of G.E. miniature and low-voltage lamps, while the process of manufacturing carbon, tantalum and

"Mazda" lamps is illustrated by the exhibit in a second cabinet. To show the difference between the current consumed by a 100-watt carbon lamp and a 40-watt "Mazda" lamp, both of which give the same candle-power, an ammeter has been connected into the circuit. Incandescent lamps of all sizes from 25 watts with prismatic glass shade to the 500-watt lamp with "Monolux" fixtures are displayed in a rack. There is also an exhibit of 220-volt multiple "Mazda" lamps. On an automobile dashboard are displayed two headlight lanterns with lamps, two side light lanterns with lamps, one dashboard lantern with lamps and one trailer light with lamps. A new type of 30-amp mercury-arc rectifier for charging electric vehicles is on exhibition. It is designed for charging 24-cell to 30-cell batteries and can be operated from 110-volt or 220-volt alternating-current circuits. The rectifier is made up in one complete unit. A solenoid-operated oil switch and circuit-breaker is shown and represents the latest design in this type of remote-control device.

General Vehicle Company, Long Island City, N. Y., which manufactures electric commercial vehicles exclusively, has an interesting exhibit of vehicles which it has recently sold. One is a 2000-lb. wagon which will be operated by the United Electric Light & Power Company, of New York, and is one of seven vehicles recently ordered to complete that company's equipment of electrics. The other exhibit is a 3½-ton chassis which has been sold to the Schwarzschild & Sulzberger Company, of Chicago. This vehicle is equipped with an underslung battery, which can be readily removed and a newly charged battery installed, thus enabling the owners to obtain double the radius of the rated capacity of the vehicle. The machine is jacked up in order that the operation of the chassis can be easily demonstrated. In addition the General Vehicle Company has on exhibition in its booth one of its new commercial arc rectifiers for use in charging electric vehicles. The company is represented by Messrs. C. W. Squires, A. P. Bourquardez, W. L. Brown and Louis Ruprecht.

Goulds Manufacturing Company, Seneca Falls, N. Y., shows one of its triplex power pumps working in connection with a glass tank illustrating the automatic operation of the motor by the rise and fall of water in the tank, which is intended to correspond to the house tank in a residence. A number of triplex pumps are also shown lying idle. The following representatives of the company are in attendance: Messrs. W. E. Dickey, W. H. Hopper, F. R. Harty and W. H. Valentine.

Gould Storage Battery Company, New York, has sparking, vehicle and street-car storage batteries on exhibition. Details of the grids and photographs of the Third Avenue storage-battery cars are shown. The Gould company has developed both pasted and Planté plates to cover the varying conditions of service. The thin plates are pasted and have high capacity without sacrifice of durability. The Planté form of positive plate is spun from a blank sheet of lead into thin, close-spaced parallel ribs and grooves resulting in large grid surface. The active material is formed electrochemically. It is stated that Third Avenue cars equipped with Gould batteries have given 105 miles on a single charge. Messrs. W. J. Dowd, G. Hayes and H. Seikerman represent the company.

Gudeman & Company, New York, exhibit their regular line of electrical decorations augmented by some designs which have never been shown before. A feature of the display is an electric fountain, which the company has recently started to manufacture. The electric decorative designs cover all kinds of flowers and fruit, the latter being represented by the lamp bulb itself and the former being made of fireproof material in which an electric lamp is hidden. Mr. L. Gudeman is in attendance.

C. J. Halle Sales Company, New York selling agents for the Nuway Electric Cleaner, has a working exhibit of vacuum cleaners. The cleaner comprises four parts—the casing with its wires, the hose, brush and nozzle. Within the casing is a centrifugal fan driven by a ⅛-hp universal motor and a copper chamber in which the fan deposits the dust and dirt. The mechanism is enclosed in a hardwood cabinet 14 in. x 14 in. and the entire device weighs 25 lb. Those in attendance are Messrs. C. J. Halle, M. C. Beard, J. J. Flanagan, J. T. Robinson and I. A. Nohe.

Helios Manufacturing Company, Bridesburg, Philadelphia, Pa., in its booth near the entrance shows its arc lamps, storage batteries, meters and the Helios economic lighting system. The latter is shown in operation in connection with a motion-picture machine and comprises a motor-generator set whose installation not only enables the operator to obtain a clearer and steadier light, but it is claimed also avoids waste of energy which would otherwise obtain through the resistance necessary in connection with the hand-fed arc lamp. The arc lamps shown include, besides the line of lamps which the company has been manufacturing for over seventeen years, the Helios flaming arcs applicable for both direct-current and alternating-current circuits and giving about 2300 cp. Storage batteries for lighting and vehicles are on view, as well as Bastian meters. The latter are intended for direct-current circuits and are especially applicable for residence work where the number of lamps in use is small and where the installation of an expensive meter would be a consideration.

Holophane Company has two sample boards erected in its booth. The rear board is fitted with residence-type glassware showing against a black background and a board or rack at the side is fitted with the company's various forms of prismatic-glass reflectors in different finishes and its metal reflectors. Two posts at the entrance to the booth are equipped with tungsten lamps and glass shades, and are intended for street-lighting service. The new "Stilleto" prism is shown developed in the extensive, intensive and focusing types. The reflector is more efficient than the old style of prism and admits of more graceful designs. The following persons are attending: Mr. J. W. Foster, Mr. A. Marshall, and Messrs. Miller, Grotz, Bradbury, Timper, Feher and Whiting.

Hughes Electric Heating Company, Chicago, Ill., shows its line of electric cook stoves. These appliances resemble an ordinary gas or gasoline stove and are equally as cheap in first cost. They are built so that the housewife can perform all kinds of cooking, baking and other work required of a kitchen stove with the ordinary kitchen utensils. The heating units are removable and can be renewed by the housewife without the slightest difficulty. The latest product of the company shown is a kitchen range with self-contained oven and broiler. This stove is attractive in appearance and is of substantial construction. The company is represented by Messrs. G. A. Hughes and G. D. Smith. Lady demonstrators show the method of operating the stoves and obtaining the three degrees of heat.

Hurley Machine Company, New York, is exhibiting the famous "Thor" electric home laundry machine and Thor ironing machine. At various electric shows this machine has been operated in a competitive test again women actually washing clothes, and one Thor machine has washed and wrung by electricity three times as many clothes as three women using the old-fashioned rub-board method. A new feature in connection with this machine is the Thor universal rod, which is attached to the flywheel of the washer and will operate an ice cream freezer, grindstone, churn, cream separator, or any other small article around the house. The Thor exhibit is in charge of Mr. Neil C. Hurley and Mr. William A. Murfey. Many of the sales force from the Chicago office are also at the exhibit, including Messrs. Nolan, Conlon, Haynie, Contzen and Kaynor.

International Correspondence Schools, Scranton, Pa., features its Electrical Engineer's Handbook and seven other handbooks. Besides these the numerous courses in electricity are shown and the methods of teaching explained. Some of the work of students who have graduated is on exhibition as well as the International Library of Technology, consisting of 103 bound volumes covering 210 courses.

Kinetic Engineering Company, Philadelphia, has two organ-blower outfits on exhibition, one being equipped with a single-phase induction motor and the other with a direct-current motor, both of which are ready for service. These blowers are used quite extensively in New York churches, and are very quiet in operation. Mr. S. H. Ebert is in charge.

Lansden Company, Newark, N. J., exhibits an ambulance, a standard, one-ton, rack truck, and a three-wheel industrial truck. The ambulance has 65 cells of Edison type-A4 battery and is rated to carry a load of 600 lb. for 45 miles at a speed of 15 miles per hour. The wheelbase is 112 in. and the tread 56 in. Sweinhart cellular solid rubber tires, 32 x3½ in., are used, and a General Electric motor giving four speeds forward and two speeds backward. The fittings include standard sliding bed, upholstered in leather; standard brass hand-

Fig. 3—General View of New York Electrical Show, Looking Southwest.

lantern with bracket attached to inside of body; dome lamp in roof; medicine case; bandage boxes and splint racks; speaking tube from doctor to driver; doctor's seat across rear hinged at one side to fold up out of the way; doctor's back straps across side openings; doctor's arm loops suspended from roof; sides padded and trimmed with leather for a height of one foot above bed, above this point finished in natural wood; tail gate and rear step. The outside fittings include two electric side lamps, one electric tail lamp, rotary foot gong and electric horn, odometer, charging plug, battery filler, storm apron and tool kit. The particular feature in the ambulance to which attention is called is the coil-spring suspension. This is a matter which has been very carefully worked out through a series of exhaustive experiments covering over three years, and it is now developed to a point where most remarkable riding qualities are achieved. In no class of vehicle is this more essential than in an ambulance, and it is claimed by the maker that no vehicle ever built to be operated over ordinary streets and highways has equaled the perfect smoothness of this construction. The standard rack truck is equipped with 60 cells of the Edison type-A6 battery and rated to carry its full load of one ton a distance of 45 miles on each battery charge at a speed of 10 miles an hour. The three-wheel industrial truck is said to be the smallest electric vehicle for its rated load capacity ever built. The top of the platform is only 27½ in. from the ground, and the platform dimensions are 6 ft. long by 54 in. wide. The truck is rated to run 18 miles on each battery charge at a speed of 4½ miles per hour, carrying its full load of two tons the entire distance. The driving wheels are 24 in. in diameter, shod with 6-in. rubber tires. The single steering wheel is 18 in. in diameter with a 6-in. steel tread. Various sizes and types of industrial trucks are built to suit the individual requirements of the purchasers. They are designed for use in and about steamship piers, railway terminals, warehouses, factories and mills. They eliminate the expensive and troublesome tracks, switches and turntables required when industrial railways are employed, can be run all over the plant, onto elevators and through narrow passage ways, picking up and delivering their loads exactly where wanted.

A few general characteristics of all Lansden construc-

tion are the employment of a wood frame which is much lighter and more flexible for a given strength than pressed steel or channel iron frames; the use of a single motor, driving to a differential countershaft, thence by side chains to the rear wheels; the employment of the Lansden patent self-oiling, loose-sleeve bearings; the Lansden continuous torque controller giving a constant, uninterrupted driving effort through all speeds, the use of a flat, spring steel countershaft which absorbs the sudden pull of starting by torsion and which, with the continuous torque controller, prevents any violent strains on chains and tires, thereby materially increasing their life. In attendance are Messrs. John M. Lansden, Jr., F. A. Whitten, John Milliken, W. J. Joller, J. R. Kinsey, F. B. Tyler, Harry Taylor, A. Figman and Victor Villar.

Macbeth-Evans Glass Company, Pittsburgh, Pa., displays special lines of glassware for use in connection with electric fixtures with particular reference to the new "Alba" glass reflectors for use with tungsten lamps. These are all shown under actual working conditions, and, in addition to the reflectors in this glass of varied shapes, the company exhibits this glass made in structural forms and illuminated. Throughout the Garden "Alba" glass reflectors are used in connection with the illumination. There is a fairly comprehensive line of electric globes which are made for home lighting, etc., in varied shapes and finishes also on exhibition. Messrs. L. W. Young and G. N. Lukens are in attendance.

Manhattan Electrical Supply Company has a line of electric heating, therapeutic and telephone instruments and other supplies on exhibition. The company manufactures the "Red Seal" dry battery, as well as other batteries and specialties, and in the center of its booth has a large section of a battery within which is depicted the North Pole with a number of red seals on the ice, the idea that the company wishes to convey being that its batteries are used everywhere. Messrs. P. R. Frost, A. B. Cole and Nate Walker are present.

Metropolitan Engineering Company, Brooklyn, N. Y., has a display board fitted with a complete line of Murray protective devices, including meter seals, fuses, cut-outs, terminal protectors, etc. Electric signs of various types and a meter distribution panel board are on view. A new type of interior illuminated sign employing tungsten lamps is featured. Mr. R. M. Mann represents the company. Immediately adjoining the booth is one of the National Ball Game Company, where several ball games are demonstrated by Mr. K. S. Chamberlain. At the rear of the booth is a revolving base ball made up of red, white and blue lamps connected to a flasher.

Moore Electric Company, Newark, N. J., makes a display of its white light especially suitable for matching colors. The lobby of the Garden is also fitted with the Moore tube. Messrs. R. F. Riblet, W. T. Dixon and V. Burnett represent the company.

National Electric Lamp Association.—The Engineering Department of the National Electric Lamp Association occupies two large booths immediately to the right of the main entrance to the arena. An unusually elaborate display of incandescent lamps is made. There is a complete line of "Mazda" 110 and 220-volt lamps from the 25-watt to the 500-watt size, together with the "Mazda" street series, sign, miniature and low-voltage lamps. The tantalum line is shown complete, including the regular 110-volt and 220-volt lamps and the street railway types. Many of these lamps are shown burning on two attractive racks while the remainder are arranged in tastily decorated display cases. A very attractive feature is presented in the "Holophane Tree," a special fixture for showing "Mazda" lamps with the different sizes of the new "Holophane Stilleto" reflectors. This unit is connected to a flasher and each size of unit is flashed separately. An automobile electric lighting outfits is displayed with head lamps, side lamps, tail lamps, limousine and meter lamps. The booth is in charge of Mr. A. J. Hitzker and Mr. H. J. Raymond of the engineering department, and a large number of representatives of the association are in attendance.

New York Electrical School has placed on exhibition the Korn photo-telegraphic machine and also exhibits by means of photographs the practical work being done in the school and the methods pursued in teaching. Drafting specimens executed by students are shown and literature bearing on the aims of the institution, methods of instruction, etc., is distributed at the booth. Since the work done in this school is primarily of a practical nature, it is hardly possible to do justice to it in an exhibit of the kind given in Madison Square Garden. Messrs. J. L. O'Connor and George J. Cox are in charge of the booth.

Opalux Company, New York, shows new wide, medium and narrow angle types of reflectors as well as the older flat and bowl types. From these styles is offered a choice of form best suited to the particular use to which the reflectors are to be put. All the forms are applicable to residential as well as to public and commercial lighting. The aim of the company is to perfect and standardize the various lines without impairing the high efficiency possessed by the reflectors. Several new forms for all popular sizes of lamps and for various lighting conditions have been brought out. Messrs. L. R. Hopton and H. M. Slauson are in attendance.

Otis Elevator Company has a working exhibit of a traction elevator giving car speeds of from 500 ft. to 600 ft. per minute. Automatic stops such as are used to stop the car at the top or bottom of the elevator hatch regardless of the operator are also shown in operation. Mr. G. H. Malcolm is in charge of the exhibit.

Pelouze Electric Heater Company, Chicago, shows for the first time its complete line of electric heating devices, including coffee percolators, chafing dishes, teapots, frying pans, boilers, water cups, etc., in addition to a full line of the well-known Pelouze irons. The stoves of this company have a patented truss structure which concentrates the heat in a copper top.

Philadelphia Storage Battery Company has an exhibition board fitted with grids and parts of batteries illustrating the make-up of the battery. A special feature of the display is its long-distance battery, which is made up of thin plates for electric vehicle work. Various types of pleasure and commercial vehicle batteries are arranged in the booth. Mr. W. L. Thompson is in charge assisted by Messrs. Davis, Marr and Everett.

Charles S. Powell & Co., New York, exhibit a 70-hour Star flaming-arc lamp and some large tungsten lamps. The largest tungsten lamp shown is rated at 1000 watts and has a specific consumption of 1 watt per candle-power. Representing the company are Messrs. C. S. Powell, W. M. Murphy, R. Irving and W. Cummings.

Reimer's Electric Heater Company, New York, has a large number of electric flatirons on view, some of which are fitted with regulating switches and some of which are not. With the former type of iron five degrees of heat are available. Demonstrators show the application of the iron in pressing cravats and clothes, and in the center of the booth is an electrically operated pleating and ironing machine. Messrs. M. V. Darcy and A. Reimer are in attendance.

Richmond Sales Company, New York, is exhibiting the "Richmond" suction cleaner in a booth bearing the inscription "One dollar puts the 'Richmond' in your home." This accords with the advertising campaign carried on by the manufacturer of the cleaner, the McCrum-Howell Company. Four of the most popular types of machines are shown as follows: The "Richmond" No. 11, a 1-hp, one-sweeper, motor-driven, direct-connected rotary-pump machine; the motor, vacuum producer, dust separator with automatic dust trip, automatic oil separator and clarifier being all mounted on a single cast-iron base. This machine is designed for residences of moderate size, or for other buildings with similar floor, wall and ceiling areas. "Richmond" No. 121, a 2-hp, one-sweeper, electric motor with a horizontal, double-acting, cylinder pump, belt-driven from

motor, complete, with dust separator, mounted on a single cast-iron base. This machine is also designed for small and medium-size residences and other similar buildings. It is silent running, positive in its action and has a dry-strainer dust separator with automatic strainer cleaner. "Richmond" No. 21, a 2-hp, one-sweeper, motor-driven, positive-acting rotary pump; direct connected and silent running with automatic control, automatic oil separator and clarifier, centrifugal-vertical dry dust separator and automatic dust trip, all mounted on a single cast-iron base. This machine is intended for large residences, small hotels, small schools, small club houses and buildings with similar floor, wall and ceiling areas. "Richmond" Nos. A-1 to A-6. This is a series of steam aspirator vacuum producers (one size of which, only, is shown) built in units of six different styles, namely, one-sweeper, two-sweeper and so on up to and including a six-sweeper unit. These units are coupled in parallel to furnish plants requiring more than six sweepers up to any number desired. The system is for heavy service in large buildings having steam of 60 lb. and over, boiler pressure. "Richmond" aspirator vacuum cleaning systems operate entirely by means of an expansive steam jet. Once the steam is turned on the vacuum is literally "on tap," like water, gas or electricity. An automatic control valve governs the steam supply, and when the tools are not in use acts as a position cut-off, thus closely proportioning the amount of steam used to the amount of work performed.

Rider-Ericsson Engine Company, New York, has as the special feature of its exhibit a working model of the "Reeco" pressure tank system. This outfit is automatically controlled; the pump maintaining a constant pressure in the tank containing the water and starting and stopping automatically according to the amount of water used by the various fixtures. Present at the booth are Messrs. W. Sayer, F. R. Chinnock and H. L. Shartle.

Rosenfield Manufacturing Company, New York, is exhibiting the "Magic" electric suction cleaner, which weighs 10 lb. The device is of the type having the bag for the dust and dirt attached to the handle. The motor runs in a horizontal position and is mounted on a carriage with two wheels. Self-feeding wick oil cups are mounted underneath each bearing and by tilting the handle downward a chain attached to the handle lifts the suction nozzle from the floor, enabling the machine to be wheeled over obstructions or to be moved about without carrying it. The suction slot is over ½ in. wide, the idea being to displace a large quantity of air under low pressure. For this purpose also a 2-in. hose is used.

Safety Insulated Wire & Cable Company, New York, exhibits a service box about 3 ft. x 4 ft. and 4 ft. high, built of brick, showing a 16-duct run, such as is installed by the company's underground construction department, connected to the box. The method of connecting a New York City fire-alarm box is shown and an ornamental tungsten post connected to the service box by short runs of conduit is on exhibition. A board having several styles of joints for deep sea submarine and underground rubber and paper-insulated cable, together with numerous photographs illustrating underground installations in various stages of completion, is displayed. Other boards illustrate in a general way the types of paper-insulated and rubber-insulated cables manufactured by this company. Fine Para rubber, which is used in making up rubber cables, is shown in the form of biscuits. Mr. G. M. Haskell is in charge of the booth. Others in attendance include Messrs. R. C. Smith, O. R. Grant and R. C. Wilson.

Santo Sales Company, New York, representative of the Keller Manufacturing Company, of Philadelphia, has on exhibition three special display Keller-Santo cleaners placed on a table or pedestal, the casing being white, red and blue. Each case has a window with corresponding colored lamps to show the working parts. Nickeled sign holders accompany the machines with silk transparent sign reading "Keller-Santo vacuum cleaners—Made in America—Used all over the World." Use is also made of a school-house globe with a transparent sign reading "Keller-Santo cleans up the earth." Another novelty which attracts attention is a miniature house on a table with a sign reading "Have a Dustless Home." There is a large lobby frame showing interior and exterior views of the factory employees, etc., and signs indicating the nature of business, location of factory, etc. The staff of representatives is as follows: Messrs. Knowles, King, Kelsey, Nestor and Colvin. In addition Mr. David M. Wattel, besides showing pictorially the practical usages of the device from a cleaning standpoint, illustrates by means of sketches what can be done with it from an artistic standpoint.

Shelton Electric Company, New York, makes an imposing display of its hair dryers and therapeutic machines, which are made in various sizes. The company features its white enamel "Dragon" pedestal vibrator, the vibrations from which pass through the fingers of the operator, thus combining mechanical and hand massage. The strength of the vibrations is controlled by means of an ingenious lever regulating device which instantly changes the strength of vibration from a mere tremor to the most powerful stroke that can be used in vibratory massage. The Shelton portable hair dryer weighs only 2.75 lb. and throws a powerful stream of either hot or cold air. All the devices are made for standard voltages and circuits. The following persons are in attendance: Messrs. Gentry Shelton, A. J. Crowley, John Kelly, A. H. Mood, Joe Irwin, George Mood, John Mulvey and J. H. Rees.

Simplex Electric Heating Company, Cambridge, Mass., through Roger Williams, its New York agent, shows its regular line of goods, consisting of flatirons, toasters, water cups, heating pads, glue pots, boilers, irons, double boilers, frying pans, etc., etc. There is also shown a new signal switch approved for New York City use by the New York Board of Fire Underwriters which will allow the ordinary plain handle iron to be used in that district. There is also on exhibition a new, flush-type, curling-iron heater which sets into the wall, only the front plate being exposed. Three hundred and seventy-five of these devices are being installed in the Ritz Carlton Hotel, Madison Avenue and Forty-seventh Street. In addition the company shows its theater-type, curling-iron heater, which is very popular in New York. Toasters are in operation, but general cooking is avoided, as the Public Service Electric Corporation has an exhibition alongside in which Simplex goods are used to demonstrate cooking. The exhibition is in charge of Mr. Roger Williams, assisted by Messrs. Clyde A. Flint, Charles O. Haggist, John Ehler, William Weiler and Mrs. S. McGeorge.

Simes Company, New York, exhibits a line of artistic fixtures, including glass domes, shades, portables and brackets. Representing the company are Messrs. Miller, Simes and Hawkins.

Spencer Turbine Cleaner Company, of New York, shows its standard, permanently installed, turbine-type of vacuum cleaning apparatus, together with a smaller model recently designed for use in the average-sized residence. Both machines are in operation. The feature which distinguishes the Spencer from other vacuum cleaners is the very large quantity of air moved per minute and at low pressure. Cigar stumps, nails, metal rings, etc., are taken up with ease by the machines and yet, owing to the low nozzle pressures, the fabric of rugs, carpets, etc., is not destroyed. The tools employed are larger than the ordinary and possess features of merit not found in other tools. Messrs. Ira H. Spencer and E. W. Muzzy, of the home office at Hartford, Conn., are in attendance, as are also Messrs. Guy H. Noble, S. W. Bowerman and R. P. Hoover, of the New York office.

Studebaker Brothers Company, of New York, is represented at the show by Messrs. Wm. P. Kennedy, R. R. Clayton and R. W. Knowles. There are two commercial and one pleasure vehicle on exhibition. The Model 25 commercial vehicle exemplifies the latest development of electric machine

for package delivery and is intended for two lead battery equipments, each of twenty-six cells. Each of the batteries is capable of a daily city service of thirty-five miles and the two batteries can render a continuous daily service of seventy miles, which is a greater radius than can usually be covered in the time available for delivery. The battery compartment is arranged for the accommodation of the Edison battery, only forty-four cells being required either of the "A-4" or the "A-6" type, depending on the mileage desired. The machine is fitted with ball bearings throughout, and has 42-in. driving wheels. Over seventy-five machines of this size and design are in daily service in New York City. Model 27 commercial machine is intended as a light two-ton truck or for such service where two tons is the occasional maximum load. Among the features of this machine is the supplementary suspension of the battery independent of the regular vehicle springs by means of a spring cradle within the battery compartment. This has the effect of preserving the battery from vibration and consequently prolonging the life of the plates. The battery jars in this equipment are fitted with 3-in. bridges, so that sufficient space is provided for the collection of such active material as may be deposited during the useful life of the plates. The model is equipped to accommodate four sizes of lead battery and two sizes of Edison battery. Large 42-in. driving wheels reduce the jolting or vibration of the machine, lengthen the tire life by providing a greater and slower moving circumference and the increased leverage proportionately reduces the energy consumed. In the lubrication of the principal bearings oil cups and similar devices are done away with and in their stead is substituted the railway waste-box method of lubrication. The pleasure vehicle exhibited is a ladies' victoria phaeton in which the comfort of the occupant in riding has been a prime consideration and the vehicle is hung so low as to make access and egress easy. The mechanical construction is of the best and is indicated principally by the rear-axle equipment, which is of the floating type. The chassis can be equipped with a variety of bodies to suit the customer's individual requirements. The electrical and mechanical control is of the simplest type and is designed to be used in the most automatic manner suiting the convenience of the operator.

Sunray Electric Lamp Manufacturing Company, New York, shows twelve of its arc lamps in various ornamental fittings and equipped with different shapes of globes. Instruments showing the consumption of the lamps are connected in circuit, and literature describing the company's product is distributed. Mr. Max Mayer is in charge of the exhibit.

United States Lighting & Heating Company has on exhibition parts of the National batteries as well as complete vehicle batteries, sparking batteries, stationary batteries and a tungsten automobile lighting outfit. Messrs. A. H. Ackermann, A. Russell and W. G. Davis are present.

Unique Art Glass & Metal Company, New York, makes a very creditable showing of art-glass domes and portables. Mr. Bayley represents the company.

Watson-Stillman Company, New York, is exhibiting five motor-driven "Twinvolute" turbine pumps as follows: A 2-in. two-stage pump driven by a 10-hp General Electric motor and suitable for delivering 100 gal. per minute in twelve-story to twenty-story buildings. A 2-in. one-stage pump driven by 5-hp Westinghouse motor and suitable for delivering 100 gal. per minute in eight-story to ten-story buildings. Two 1-in. pumps, one driven by a direct-current and the other by a two-phase Westinghouse motor. Both of these pumps are suitable for furnishing water supply in tenement houses, six-story to seven-story buildings, factories, etc. A single-stage turbine pump driven by ½-hp Wagner motor is also shown and is suitable for water supply in private residences. In connection with the last pump there is applied the Watson-Stillman system of automatically controlling the level in the tank. This is accomplished by an automatic tank switch which starts the motor as the water level gets low, and stops it as the level reaches the desired limit. Twinvolute turbine pumps are made for any delivery from 2 gal. to 150,000 gal. per minute and for discharge pressures up to 500 lb. The exhibit is in charge of Messrs. Harry A. Prindle, John Ketcham and Frank Clark.

Westinghouse Electric & Manufacturing Company has on exhibition a representative line of the different pieces of apparatus which the company has shown for some time, the apparatus on view being the complete outfit which was shown at the Ohio Valley Exhibition in Cincinnati during the month of September. Type "S" and "SA" motors, together with controlling apparatus for constant and variable-speed work, and type "MT" and "K" motors for direct-current work, such as hoists, cranes etc., are on exhibition. Among the alternating-current motors is shown a type "MS" motor especially designed for heavy duty, such as is found in steel mills and where the service is usually hard and severe. This "MS" motor is partly dismantled to show the rigid construction of the brackets and frame. Among the small motors for use in stores and in the home there are different sizes of type "DA" and type "DZ" motors, together with representative sizes of a complete line of buffing motors for both alternating current and direct current. An interesting feature of the exhibit is a counter given over to heating and cooking apparatus. On this counter is shown a complete line of electric apparatus, such as disk stoves, toaster stoves, etc., electric radiators, air heaters and tailor's irons. A part of the tailor-iron exhibit is an automatic tailor's iron, complete with stand, this iron being so designed that it takes energy only when the iron is placed on the stand so that the operator does not have any cord attached to the iron when pressing. In the meter exhibit the company shows a graphic recording voltmeter connected to a circuit showing the fluctuations in voltage as supplied to the booth. Among the portable instruments shown are voltmeters, ammeters and wattmeters complete, with the necessary portable shunts and series transformers. The line of switchboard instruments is represented by several different types of voltmeters and ammeters. In this section of the exhibit are also shown a static ground detector, syncroscope and several types of watt-hour meters. In the arc-lamp exhibit are several magnetite arc lamps partially dismantled to show the simplicity of the design of this piece of apparatus. Controlling apparatus, such as oil switches and oil circuit-breakers, some of which are provided with overload and no-voltage release devices, are set up so as to be easily operated and to show the principal parts of the operating mechanism.

Westinghouse Lamp Company had burning one of each size of its new wire-type tungsten lamps for 110 volts ranging in size from 15 watts to 500 watts. As an operating exhibit for 220-volt tungsten lamps, the company shows the complete line ranging in size from 40 watts to 500 watts. The lay exhibit of lamps includes sign lamps of both carbon and tungsten filaments and a complete assortment of metalized-filament lamps of all standard sizes and for all standard voltages. The company also has in its lay exhibit a few of the wire-wound street series tungsten lamps for street lighting. Among those in attendance at the exhibit are representatives from the New York offices, including Messrs. W. S. Rugg, W. Nesbit, Charles Owens, C. E. Ripenski, S. Adams, W. Conwell, G. F. Marriott, Phil Clegg, J. Kelly, W. C. Ward Paul Gerhart, H. W. Flashman. Mr. W. Barnes, Jr., representing the Westinghouse Department of Publicity, of Pittsburgh, is in charge of the exhibit.

L. A. Williamson Company, Boston, Mass., shows by means of photographs and demonstrators the application of the "Flexilyte." The booth is equipped with household furniture and the demonstrators move the small portable lamps from place to place. The "Flexilyte" consists of a case containing about 15 ft. of lamp cord, an attachment plug and a crank for winding the cord on the center portion, which is a lamp socket. Messrs. L. A. Williamson and F. E. Knight are present.

Industrial and Commercial News

The Week in Trade.

PROBABLY the best thing that can be said of the condition of trade last week is that it showed some improvement in tone. There is as yet very little enlargement in general demand, and buying shows very little increase. There is little disposition to anticipate distant requirements, and trade lacks character. The same conservatism that has been referred to so often is still in evidence. Neither jobbers nor retailers are willing to invest very heavily. In fact, many retail establishments are now running on lower stocks than is customary, and are inclined to buy from hand to mouth. In the iron and steel industry there is a rather better feeling, but not much increased activity. The wire products are the best in this line. The production of pig iron continues to run ahead of requirements, but prices have not as yet been shaded. The demand for structural material is of the small lot order, but the volume in the aggregate is as satisfactory as can be expected at this season of the year. One important railroad last week placed an order for 15,000 tons of steel rails, which is the first considerable order for this commodity that has been placed for several months. Weather conditions during the week have not been satisfactory. In the East there have been unseasonably high temperature and extended drought, while the Southwest has suffered from an excess of rain. Collections as a whole are fairly good, and have been much helped in both the West and South by the free marketing of crops. Business failures for the week which ended Oct. 6, as reported by *Bradstreet's*, were 192 as against 211 the previous week, 203 in the like week of 1909, 256 in 1908, 192 in 1907 and 192 in 1906.

The Copper Market.

WITH the exception of January, the report of the Copper Producers' Association for September showed the greatest decrease on surplus stocks of any month during the year. The decrease as reported was 2,008,753 lb. The figures given out by the association for September were: Production 119,519,983 lb.; domestic deliveries 64,501,018 lb.; export deliveries 75,106,496 lb., making total deliveries of 139,607,514 lb. The decrease in production was 8,283,635 lb., and the increase in total deliveries was 10,044,463 lb. The total amount of surplus stock that is now reported to be on hand in this country is 148,793,714, which is about 7,000,000 lb. more than the total stock at the beginning of the year. One of the most interesting features of the report is that production fell off during the month in actual daily average. Producers, however, are of the opinion that this decrease did not come from the curtailment policy which was adopted Aug. 1, because the results of this cannot how in refinery figures until the next statement appears. It is anticipated that the effects of curtailment will show very markedly in the report for October. It is claimed by some market authorities that the apparent decrease of 20,000,000 lb. in the surplus stocks of copper does not mean that consumption has at last caught up with production. It is said that this decrease resulted mainly from the shifting of stocks from producers to dealers, consumers and speculators. Such shifting, of course, does not cut any figure with actual consumption, and it is claimed that the actual melting is still as far behind the actual production as ever. In the meantime many copper authorities are very much encouraged over the situation, and Daniel Guggenheim, president of the American Smelting & Refining Company, who has just returned from Europe, declares that he has never known a period when the actual consumption of copper in Germany and England was as large as it is at the present time. Prices during the week were slightly advanced, and selling agents and producers were not inclined to make concessions. Exports for October up to and including Oct. 10 were 7202 tons. Daily call on the Metal Exchange, Oct. 10, quoted standard copper as per the accompanying table.

Standard copper:

	Bid.	Asked.	Settling price.
Spot	12.20	12.40	.....
October	12.20	12.40	12.30
November	12.20	12.40	12.30
December	12.20	12.45	12.32½

The London market, Oct. 10, was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	56 6 3	56 2 6
Standard copper, futures	57 3 9	57 0 0

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 0	53 7 6
London, best selected	65 10 0	57 15 0

Industrial and Commercial Notes.

General Electric Company Contracts.—The General Electric Company is building for the Indiana Steel Company, Gary, Ind., a seven-panel switchboard to control feeders of 220 volts in its coke oven plant. The combined rating of this switchboard is 22,000 amp. The company will furnish the entire controlling equipment, among which will be four 6000-amp, six 3000-amp and two 2000-amp circuit-breakers mechanically interlocked in pairs on the outside legs, and twelve 5000-amp lever-switches. All of these parts are stock equipment. The company is also building for the Long Beach, Cal., steam station of the Southern California Edison Company a large switchboard to control one 15,000-kva, 11,000-volt turbo generator; three 2000-kw, 11,000-volt local feeders; two 11,000-volt to 70,000-volt 6000-kw step-up transformers; two 35,000-volt and two 70,000-volt outgoing lines. The company has also received an order from the Union Light & Power Company, of St. Louis, for sixteen series mercury-arc rectifier outfits for use in connection with direct-current series arc lamps. Each consists of panel, two tubes, constant-current transformer, exciting transformer, static discharger and direct-current circuit reactor. Each set will take alternating current from the line at 6600 volts and 25 cycles, and will rectify it to operate seventy-five 6.8-amp series luminous arc lamps. The General Electric Company installed for this same concern eight of these outfits about a year ago, and it is claimed that their operation has been so satisfactory that the additional order has been placed.

Moore Lamps in Europe.—The rights for France and Belgium of the Moore vacuum tube lamp have just been acquired by a group of capitalists headed by Otto Markiewicz. The new company bears the title of "La Lumière Moore," and will have its headquarters in Paris, temporarily at Hotel Regina. In connection with these transactions a series of experiments and tests of all the colors on both the tube and window forms of the lamp was conducted for the foreign capitalists by Professor Wedding, of the University of Charlottenburg. He is quoted as giving his conclusion that the Moore lamp is "the most advanced of all forms of illumination." A year ago the "Allgemeine Moore-Licht Gesellschaft" was established in Berlin and a little later an auxiliary operating company, the Moore Licht Aktiengesellschaft. Russian, Norwegian and Swedish companies have been organized within the last year and the lamps are said to be in use in more than thirty European cities.

McAdoo Tunnel Extensions.—The Hudson & Manhattan Railroad Company, which has received a franchise from the Public Service Commission to extend its lines from the Thirty-third Street station at Sixth Avenue to the Grand Central Station, in New York, has asked for and received an extension of six months in which to begin work. The company states that it found it impossible to prepare the necessary plans and specifications for the beginning of work on Sept. 1.

Hupp Automobile Company to Build Electrics.—The Hupp Motor Car Company, of Detroit, manufacturer of a highly successful small gasoline automobile, has organized a subsidiary company for the manufacture of electric vehicles. The new cars, the first one of which was recently exhibited on the streets of Detroit, embody several distinctive features of design and will shortly be made ready for the market.

Street Lighting in Europe.—Theodore Stave, president of the Stave Electrical Company, has recently returned from an extended trip in Europe. Mr. Stave spent several months abroad, and devoted his time largely to a careful study of the lighting situation in Europe. He says that the flaming arc for street purposes is rapidly coming into favor, and that the only drawback is the shortness of life of the electrodes. "I found that the most serious problem which is confronting the lamp people abroad, especially on the Continent, is the competition that has arisen from high-pressure gas lamps. In Berlin especially some of the important streets and many of the side streets are being lighted by these lamps. The Grætzin inverted mantle is the type of lamp that is most generally used. There has recently been a proposition made to install these lamps on high poles similar to those now used for arc lighting, and to employ enough lamps to make each unit about 3000 cp. The lamp is very satisfactory for street purposes, and its economy is recommending it. It is estimated that in Berlin there is a saving of about 300 marks per year per lamp. This, of course, includes maintenance and all costs. I found that in all of the European countries the best effort of illuminating engineers is being devoted to increasing the life of the flaming-arc lamp. In England this is being done by the use of multiple electrodes and employing a magazine type lamp. On the Continent the principal efforts are being directed toward increasing the longevity of the electrode itself. The multiple system, of course, saves nothing in the cost of electrodes, but only in the labor of trimming. There are many places, however, in both England and on the Continent where arc lamps are being taken down and being replaced by high-pressure gas installations. One notable instance is on Regent Street and the Strand in London. It is generally admitted that the flaming arc is the ideal lamp for street lighting, but the question of economy is causing municipalities to hesitate about installing it. I believe, however, that before many months there will be on the market a number of long-burning lamps, and that the expense of flaming arcs for street lighting will be materially reduced. In many of the small cities, especially in England, gasoline lamps are being used for street lighting, the gas being distributed from central stations. Of course, the candle-power of these lamps is small, and they are mainly replacing tungsten and old-style gas lamps. I was told, while in Europe, that the Allgemeine Elektricitäts Gesellschaft had developed a flaming-arc lamp with a life of 150 hours. General trade conditions in the electrical industry are very satisfactory abroad, especially in Germany. It appeared to me that more business was being done over there than in this country."

Baltimore Consolidated Gas, Electric Light & Power Company.—S. Davies Warfield has resigned the chairmanship of the board of directors of the Consolidated Gas, Electric Light & Power Company of Baltimore. He has been succeeded by James E. Aldred, president of the Pennsylvania Water & Power Company, who was also elected vice-president and chairman of the executive committee. It is the general understanding that this change in the management of the Consolidated Gas, Electric Light & Power Company means that hereafter the counsels of the Pennsylvania Water & Power Company will be important in the management of the concern. H. S. Holt, Montreal; E. R. Wood, Toronto; Charles E. F. Clark, vice-president of the Pennsylvania Water & Power Company, and Norman James, Baltimore, were elected to the board of directors of the Consolidated company to fill vacancies. It is given out that the policy of the new management, when the energy from the McCall Dam installation is brought in, will be to encourage manufacturing plants in Baltimore. Especial concessions will be granted new concerns locating in the city, and the effort will be to make the manufacturing cost in Baltimore as low as in any city in the country. The annual report of the company for the year ending June 30, which was filed last week, showed gross earnings of $4,699,097, as against $4,449,275 in 1909; operating expenses were $2,265,533 as against $2,279,577 in the year previous. The surplus available for dividends at the end of the year was $1,059,201.

Baltimore Refrigerating & Heating Company.—A plan for the reorganization of the Baltimore Refrigerating & Heating Company, of Baltimore, has been agreed upon. The court will be petitioned to sell the property at once. The old company will be taken over by a new one which is to be formed. It was explained that New York financiers who were interested in the company have assisted Richard B. Fentress, of Norfolk, in re-financing the corporation, and are largely instrumental in perfecting the plan which has been agreed upon. The new company will ask consent of the Public Service Commission of Baltimore for authority to issue at least $2,000,000 worth of treasury bonds, which will be sold from time to time to develop the property. The new interests in the company will provide for the immediate expenditure of $100,000 for improvements to the plant. An extension of the corporation's pipes down to the City Hall will be made so as to carry out the contract for heating that building recently received from the municipality. It is not yet known whether the corporation will add an electric lighting feature to its business. From an authentic source it was learned that a meeting of the new interests behind the corporation would be held some time next week, and at this meeting the fate of the electric lighting business will be determined, which it is claimed they have a right to do under the Fentress-Medairy ordinance.

Favors a Municipal Plant.—The report on the city of Baltimore's electric light rates which Superintendent of the Department of Lamps and Lighting Robert McCuen has had in preparation for the past six months was made public last week. Among the most important recommendations was that a municipal electric lighting plant for municipal buildings and street lighting be erected to cost, including power plant, real estate, transmission lines, horses, wagons, tools, etc., $909,050. The report also says that the maintenance cost, including interest on investment, taxes, depreciation, rentals, etc., would be $247,606. Mr. McCuen further says that the cost of arc lamps would be per annum, $43.29. Present prices charged by the Consolidated Gas Electric Light & Power Company: In underground districts, $75; in overhead districts, $60.25. The report says that the cost of current for buildings would be 1.9 cents per kilowatt hour. Present price to municipal buildings 3 to 6 cents per kilowatt hour. The report declares that competition of private interests with the Consolidated company is practically impossible.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Eaton, Ind.; Jacksonville, Fla.; Hudson, Wis.; Colfax, Ia.; Broadlands, Ill.; Mason City, Ia.; Orlando, Fla.; Columbia, Mo.; Morganton, N. C.; Erwin, Tenn.; Foster Falls, Va.; McPherson, Kan.; Quesnal, B. C., Can.; Dillsburg, Pa.; Belair, Md.; Halifax, N. S., Can.; Springfield, Cal.; Kankakee, Ill.; Greensboro, N. C.; Wamego, Kan.; Hunters, Wash.; Drexel, Mo.; Sidney, Neb.; Seward, Neb.; Kansas City, Mo. and Youngstown, Ohio.

Central Colorado Power Company.—The main office of the Central Colorado Power Company has been moved from Denver to New York City, and will be located at 24 Broad Street. G. H. Walbridge, president of the company, O. B. Willcox, vice-president and head of the legal department, and John T. Adams, attorney, have moved from Denver to New York. E. L. West, who was made general manager to succeed Mr. Walbridge, when the latter was elected president, will be in complete charge in Denver.

Pennsylvania Railroad Tunnels.—The Pennsylvania Railroad Company has officially announced that it will begin service through its Hudson River tunnels between Harrison, N. J., and the new station in New York City on Nov. 27. The company has had delivered enough electric locomotives for the service, and the electrical equipment was installed some time ago. The delay in opening the tunnels was due to the fact that the signal service installation had not been completed.

Electric Delivery Wagons for Detroit Store.—The Anderson Carriage Company, Detroit, has furnished to the Newcomb-Endicott Company, of Detroit, the first consignment on an order for thirty 1,000-lb. Detroit Electric delivery trucks, for its retail business. The wagons will be equipped with Edison storage batteries.

Equipment for New York Lighting Companies.—The General Electric Company has recently sold to the Bronx Gas & Electric Company one 2000-kw turbo generator, and to the Queens Borough Gas & Electric Company a unit of the same size.

Financial.

THE WEEK IN WALL STREET.

SENTIMENT as regards securities and money conditions continues to improve, according to the majority of authorities in Wall Street. In the meantime there is very little improvement in business, and while prices have advanced there is little evidence of outside buying. Apparently the stock market has been pretty well liquidated, and there is not a great deal of stock offered for sale. This is especially indicated by the fact that adverse news, political or otherwise, seems to have little effect upon the market and causes no slump. If long lines of stock were being carried, this would not be the case.

NEW YORK.

	Oct. 3.	Oct. 10.	Shares sold.		Oct. 3.	Oct. 10.	Shares sold.
All.-Ch.	8¼	10	4,100	Int.-Met., pfd.	56⅜	56¾	12,500
All. Ch., pfd.	30*	34	1,675	Mackay Cos..	92	96½	4,500
Amal. Cop...	65⅛	66½	106,100	Mackay C.,pf.	75½	78¾	733
Am. D. T....	20½*	20½*	——	Man. Elev...	143½	145¼	6,553
Am. Loc.....	39	37⅜	4,200	Met. St. Ry..	15*	15*	——
Am. Loc.,pfd.	102½*	103*	1,200	N.Y.&N.J.Tel.	139¼*	139¼*	——
Am. Tel. & C.	75*	85	1,100	Steel, com...	70⅛	70⅜	423,780
Am. T. & T..	137⅞	137⅝	4,755	Steel, pfd....	117⅜	118½	6,700
B. R. T....	76⅛	76½	11,200	W. U. T....	74½	74½	20,680
Gen. Elec....	146	151¼	9,800	West'h, com..	66½	70	22,050
Int.-Met.	21	20⅝	12,350	West'h, pfd..	128¾	125*	900

PHILADELPHIA.

	Oct. 3.	Oct. 10.		Oct. 3.	Oct. 10.
Am. Rys.....	43¼*	43*	Phila. Elec.....	15⅞	15¾
Elec. Co. of A....	11½	11½*	Phila. R. T.....	19⅛	19¾
Elec. St. B'ty.....	48⅜	49½	Phila. Trac.....	83	83
E. S. B'ty, pfd.....	30*	30*	Union Trac.....	44	43⅞

CHICAGO.

	Oct. 3.	Oct. 10.		Oct. 3.	Oct. 10.
Chi. City Ry.....	180*	180*	Chi. Tel. Co.....	120	120
Chi. Rs., Ser. 1.....	64½	67¼*	Met. El. Co.....	19*	19*
Chi. Rs., Ser. 2.....	15½*	15⅞*	Met. El., pfd.....	60*	61*
Com. Edison.....	112*	110¾	Nat'l Carbon.....	126	127
Chi. Subways.....	4	4⅛	Nat'l Car., pfd.....	119½	119½

BOSTON.

	Oct. 3.	Oct. 10.		Oct. 3.	Oct. 10.
Am. T. & T.....	138	138	Mex. Tel.....	5⅜*	5¾*
Cum. Tel.....	143*	143*	Mex. Tel., pfd.....	6½*	6½*
Edison E., Ill.....	258	270	N. E. Tel.....	130*	131½*
Gen. Elec.....	145¼*	151	W. T. & T.....	15	19*
Mass. E. Ry.....	20¼	19⅝*	W. T. & T., pfd....	90*	90*
Mass. E. Ry., pfd...	84¾	84*			

*Last price quoted.
Shares sold for week Oct. 3 to Oct. 8.

The most important news feature that has occurred within the last week is the announcement of the United States Steel Corporation that unfilled orders at the end of September amounted to only 3,158,106 tons, which is the lowest monthly report ever made by the big corporation, with one exception, since its organization. Orders for new business have been coming in at a very slow rate, although it said that prices in many instances have been shaded in order to encourage business. Although it is generally admitted that the political situation is more complicated than for a number of years, it apparently has less influence upon the Street. In fact, there is less political talk in financial centers than in many years when the situation was of far less importance. The bond market, which showed some little improvement a few weeks ago, has not continued to develop. While there are quite a number of inquiries, there is not a great amount of buying and prices have not advanced to any material extent. The money market continues to be easy, but the situation is not altogether as lovely as it was three months ago. The banks have lost a considerable amount of their surplus reserve, and the report of the New York bank examiner that the savings institutions had lost a large number of deposits has been somewhat disturbing. Quotations Oct. 10 were: Call, 1½@2⅞ per cent.; 90 days 4⅝@4¾ per cent. The quotations in the table are those of the close Oct. 10.

FINANCIAL NOTES

Western Union Valuation.—At the meeting of the executive committee of the Western Union Telegraph Company last week a report was received from the special auditing committee consisting of Edward J. Hall, Jacob H. Schiff and Henry A. Bishop, which has for a number of months been making a thorough examination of the books and property of the company. In this work the committee was assisted by Price, Waterhouse & Company, expert accountants, and Westinghouse, Church, Kerr & Company, engineers. The report shows assets: Property account, $135,169,171; other securities owned, $30,033,640; material and supplies, $2,752,089, and current assets, $4,613,188, making a total of $172,568,088. The total liabilities, including $144,265,093 capital account, amount to $164,834,396, leaving a surplus of $7,733,692. The value of the telegraph property is stated at adjusted book figures, and represents the approximate replacement cost. No provision was made in the report for accrued depreciation, nor was any allowance made for the going value of the company's organization. With the report the accountants submitted a report of the business for the fiscal year which ended June 30, 1910, showing total earnings of $32,752,111, and operating expenses, including taxes, of $26,614,303. The net profit, including income from loans and investments, was $7,274,904.

Union Switch & Signal Company.—The stockholders of the Union Switch & Signal Company, of Swissvale, Pa., have been notified that a special meeting will be held Dec. 14 to vote on the proposition to increase the capital stock from $2,500,000 to $5,000,000. It is understood that the approval of the proposed increase will be followed by the declaration of a 60 per cent stock dividend out of the new stock, which will be distributed to both common and preferred stockholders pro rata. The remaining 40 per cent will be held in the treasury, and the directors will issue it from time to time to increase the working capital to meet the increased demands of the company. This proposed increase in the capital stock of the company is the first since it was organized. The present capitalization is divided into $500,000 preferred and $2,000,000 common, on both of which there have been regularly paid 12 per cent dividends each year.

Westinghouse Machine Company.—A special meeting of the stockholders of the Westinghouse Machine Company has been called for Dec. 8 to vote on a proposition to increase the indebtedness. While it is not definitely given out what this proposition will be, it is assumed that it is for the purpose of authorizing the financing of a new form of notes. The plan through which the company emerged from the receivership in March, 1908, provided for the issue of three-year, 6 per cent notes. The total amount of notes issued was $7,200,000, and of this amount there were outstanding at the time of the annual meeting last June $6,473,000. These notes fall due next spring, and some provision must be made for taking care of them.

Michigan Companies Issue Bonds.—The State Railway Commission of Michigan has granted to the Grand Rapids & Muskegon Power Company the authority to issue $2,215,000 in bonds; to the Pontiac Power Company to issue $114,000, and to the Bay City Power Company to issue $500,000. These properties are all subsidiaries of the Commonwealth Power Railway & Light Company, the holding concern which was organized last year by Hodenpyl, Walbridge & Company and E. W. Clark & Company. The Michigan authorities declined to allow the holding company to issue bonds, because no appraisement had been made of the physical value of the properties.

Luzerne County Gas & Electric Company.—The Luzerne County Gas & Electric Company, of Plymouth, Pa., has purchased the plant of the Wyoming Electric Light & Power Company, which has been controlled by the Temple Coal & Iron Company. The towns of Wyoming and West Wyoming have been supplied with energy from this plant, and notice has been sent to the municipal authorities of these towns that the company would begin at once to improve both the plant and distributing service. The Luzerne County company now controls the lighting systems of quite a number of townships, including the gas service, in that section.

Southern New England Telephone Company.—The Southern New England Telephone Company has increased its capital stock by $1,099,100. This increase was made to provide for extensions planned and in progress. The stockholders who are recorded Oct. 15 have the right to subscribe to the new stock at par in the proportion of one share of new stock for each multiple of seven shares held. Subscriptions will be payable $50 on Jan. 18, 1911, and $50 on Oct. 18, 1911. Last week Messrs W. F. Henney, of Hartford; A. H. Bullard, of Bridgeport, and Charles E. Lyman, of Middlefield, were elected members of the board of directors.

Commonwealth Edison Company.—The Chicago Stock Exchange has just added to its list $2,875,000 Commonwealth Edison stock, and $9,022,000 first mortgage, 5 per cent bonds. This stock is the increase which was authorized a year ago, the final payment on the subscription for which will be due Nov. 1. The bonds were sold to a syndicate a couple of months ago, and part of them were used to refund Chicago Edison 5 per cent bonds. The company's total stock listed in Chicago is $32,875,000. The total bonds listed are $27,022,000.

Great Maryland Combination Reported.—There are rumors in Baltimore that plans are being formed for a great public utility consolidation which may involve a capitalization in the neighborhood of $150,000,000. This rumor has grown up since James E. Aldred has become the dominant spirit in the Baltimore lighting situation. The corporations that are named in connection with the rumored consolidation are: Consolidated Gas, Electric Light & Power Company; Pennsylvania Water & Power Company; Washington, Baltimore & Annapolis Electric Railway; United Railways & Electric Company; Maryland Electric Railways and Annapolis Short Line. Details for the merger have not as yet been made public, but it is believed by many financiers that such a deal is being contemplated and that the Maryland Public Utilities Commission will be called upon to give its consent.

General Motors Company.—Practically all the details of the negotiations of the $15,000,000 issue of the General Motors Company 6 per cent five-year notes have been arranged, and within a few weeks the company will be perfectly easy in its finances. The notes were put out by Lee, Higginson & Company, J. & W. Seligman & Company, Kuhn, Loeb & Company and the Central Trust Company, of New York. The total authorized issue is $20,000,000, and the $5,000,000 balance between the authorization and the present issue is to be held for future uses. These notes will be redeemable at 102.5 and interest on any of the interest paying dates.

Rockingham Power Company.—When the property of the Rockingham Power Company, near Wadesboro, N. C., was offered at auction last week by the reorganization committee, there was no bid received. The upset price was $1,000,000, and the sale only covered the interest of the reorganization committee in the property.

DIVIDENDS.

American Light & Traction Company, preferred, quarterly, 1½ per cent; common, quarterly, 2½ per cent cash, 2½ per cent stock, all payable Nov. 1.

Brooklyn City Railroad Company, quarterly, 2 per cent, payable Oct. 15.

Dallas Electric Corporation, semi-annual first preferred, 3 per cent, second preferred 1 per cent, both payable Oct. 10.

East St. Louis & Surburban Company, preferred, quarterly, 1¾ per cent, payable Oct. 15.

Edison Electric Illuminating Company of Brockton, semi-annual, $4 per share, payable Nov. 1.

Fort Smith Light & Traction Company, preferred, quarterly, 1¾ per ecnt, payable Oct 15.

Lowell Electric Light Corporation, quarterly, 2 per cent, payable Nov. 1.

Northern States Power Company, Chicago, preferred, quarterly, 1¾ per cent, payable Oct. 15.

Public Service Investment Company, Boston, preferred, quarterly, 1½ per cent, payable Nov. 1.

Rio de Janeiro Tramway Company, quarterly, 1¼ per cent, payable Nov. 1.

United States Rubber Company, quarterly, first preferred, 2 per cent, second preferred, 1½ per cent, both payable Oct. 31.

J. G. White & Company, preferred, quarterly, 1½ per cent, payable Nov. 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Baton Rouge Electric Company:					
August, 1910	$9,155	$5,855	$3,300	$1,945	$1,355
August, 1909	8,681	5,519	3,162	1,951	1,211
Blackstone Valley Gas & Electric Company:					
August, 1910	81,376	40,236	41,146	30,222	10,918
August, 1909	74,405	40,071	34,334	30,441	4,893
Cape Breton Electric Company, Ltd.:					
August, 1910	30,777	15,703	15,074	6,174	8,900
August, 1909	26,669	13,806	12,863	6,207	6,656
Dallas Electric Corporation:					
August, 1910	118,257	82,637	35,620	25,659	9,961
August, 1909	112,802	72,270	40,532	28,649	11,883
Columbus (Ga.) Electric Company:					
August, 1910	39,328	16,539	22,789	17,887	4,902
August, 1909	31,783	20,311	11,472	12,677	*1,205
Edison Electric Illuminating Company, of Brockton:					
August, 1910	23,310	14,281	9,029	4,864	4,165
August, 1909	19,792	12,734	7,058	3,620	3,438
El Paso (Tex.) Electric Company:					
August, 1910	46,897	30,730	16,167	8,215	7,952
August, 1909	46,447	28,546	17,901	8,259	9,642
Galveston Houston Electric Company:					
August, 1910	124,764	65,932	58,832	25,965	32,867
August, 1909	111,295	62,976	48,319	21,679	26,640
Jacksonville (Fla.) Electric Company:					
August, 1910	47,043	27,100	19,943	9,494	10,449
August, 1909	38,782	21,292	17,490	9,520	7,970
Lowell (Mass.) Electric Light Corporation:					
August, 1910	31,667	19,636	12,031	4,863	7,168
August, 1909	26,665	15,048	11,617	4,817	6,800
Minneapolis General Electric Company:					
August, 1910	91,732	38,734	52,998	31,753	21,245
August, 1909	77,508	36,896	40,612	30,027	10,585
Norfolk & Portsmouth Traction Company:					
August, 1910	188,834	100,500	88,334	64,865	23,469
August, 1909	174,211	96,336	77,874	63,118	14,756
Northern Texas Electric Company:					
August, 1910	119,813	63,953	55,860	20,300	35,560
August, 1909	109,422	57,893	51,529	17,190	34,339
Paducah Traction & Light Company:					
August, 1910	20,780	11,807	8,973	7,071	1,902
August, 1909	19,930	11,281	8,649	6,618	2,031
Pensscola Electric Company:					
August, 1910	24,177	14,482	9,695	5,244	4,451
August, 1909	22,205	12,514	9,691	4,373	5,318
Puget Sound Electric Railway Company:					
August, 1910	173,989	100,169	73,820	52,145	21,675
August, 1909	194,383	113,367	80,516	48,800	31,716
Quebec Railway, Light & Power Company:					
August, 1910	129,323	64,029	65,294	.....	.....
August, 1909	115,136	57,659	57,377	.....	.....
Savannah Electric Company:					
August, 1910	56,870	38,680	18,190	18,181	9
August, 1909	53,931	36,384	17,547	17,435	112
Seattle Electric Company:					
August, 1910	479,573	258,749	220,824	111,081	109,743
August, 1909	610,816	312,119	298,697	108,588	190,109
Sierra Pacific Electric Company:					
August, 1910	45,636	14,206	31,430	6,028	25,402
August, 1909	44,054	11,891	32,163	5,927	26,236
Tampa Electric Company:					
August, 1910	50,346	25,070	25,276	5,959	19,317
August, 1909	48,468	28,803	19,665	4,595	15,070
Twin City Rapid Transit Company:					
August, 1910	660,656	298,323	362,333	140,112	222,220
August, 1909	641,062	262,479	378,583	140,251	238,332
United Railways of St. Louis:					
August, 1910	999,680	661,086	338,594	233,256	108,616
August, 1909	925,853	599,663	353,190	232,420	125,181
Western Union Telegraph Company:					
Year ended June 30, 1910	33,889,203	26,614,303	7,274,900	1,687,830	5,587 070
Year ended June 30, 1909	30,541,072	23,193,966	7,347,106	1,732 250	5,614,856

*Deficit.

General News

Construction News.

MONTGOMERY, ALA.—The City Council has granted the Montgomery Traction Company a franchise to construct and operate an electric light and power plant in Montgomery. It is understood that the plant will cost about $500,000.

NORTH BIRMINGHAM, ALA.—The Greensboro Supply Company is reported to be in the market for a 100-kw, 440-volt, 60-cycle, 3-phase alternator, belted type, speed not to exceed 900 r.p.m., complete with exciter, switchboard, etc.; also a generator with a rating of from 65 to 100 kw, 2-phase, 60-cycles, and one 25-hp motor for same.

ASHDOWN, ARK.—John P. Logan, of Grannis, Ark., is reported to have applied to the Council for a franchise to construct and operate an electric light plant and ice plant in Ashdown.

ELDORADO, ARK.—It is reported that negotiations have been closed whereby the plant and holdings of the Eldorado Light & Water Company have been purchased by A. B. Banks & Company, of Fordyce, Ark. It is understood that the consideration was about $125,000.

FRESNO, CAL.—The San Joaquin Light & Power Company, it is said, will issue at once $1,500,000 in capital stock, the proceeds to be used for developing and extending its system. The stockholders also authorized an issue of $25,000,000 in bonds. The company has absorbed all other light and power companies in the valley.

LONG BEACH, CAL.—The Southern California Edison Company has recently placed an order with the General Electric Company, of Schenectady, N. Y., for a large switchboard to control one 15,000-kva, 11,000-volt turbo-generator; three 2000-kw local feeders; two 11,000-35,000 to 70,000-volt, 6000-kw step-up transformers; two 35,000-volt and two 70,000-volt outgoing lines.

LOS ANGELES, CAL.—Irving E. Bush, of Rialto, Cal., and Thomas Fellows, of Los Angeles, Cal., are reported to be interested in a project to build a dam 700 ft. high across the Colorado River, just across the California line in Arizona and close to the Nevada border. The proposed dam would form a lake 55 miles long, about a mile in width with an average depth of 350 ft. It is estimated that 1,500,000 hp could be developed.

LODI, CAL.—Plans are being considered by the City Council for the installation of a municipal electric light plant in Lodi.

MARICOPA, CAL.—The Midway Light & Power Company is reported to have taken over the plant and holdings of the West Side Electric Company. E. H. Rose, of Los Angeles, Cal., has been appointed local manager.

MARTINEZ, CAL.—The Richmond Light & Power Company has been granted a franchise by the Board of County Supervisors to erect transmission lines along the public highways of the county.

MARTINEZ, CAL.—The Town Trustees are reported to be contemplating the installation of a new water plant, equipped with electric power and gasoline apparatus, the cost of which is estimated at $31,000.

MORGAN HILL, CAL.—The citizens are reported to be considering the question of calling an election to vote on the proposition to issue $20,000 in bonds for the installation of water and light systems.

PASADENA, CAL.—Announcement has been made by Mayor Earley that the City of Pasadena will put in an application at once for energy to be supplied by the Ownes River electric plant, owned by the City of Los Angeles, when completed.

SANTA CRUZ, CAL.—The City Council has accepted the proposition submitted by the Coast Counties Light & Power Company for lighting the city for a term of years. Under the terms of the contract the company is to furnish arc lamps for lighting the entire city at the rate of $4.50 per arc lamp per month.

SMARTVILLE, CAL.—Work has commenced on the construction of a substation in Smartville. The plant will supply electricity for lamps and motors in this town and vicinity. The Tarr Mining Company has equipped the machinery in its mines for electrical operation.

SPRINGVILLE (P. O. OXNARD), CAL.—The Holley Electric Railway Company has recently purchased a site in Springville on which it will erect a power plant. Work on construction of the plant will begin in the near future.

TAFT, CAL.—The West Side Electric Company has purchased the property of the Moran Electric Company, owned principally by the business men on the north side. Electricity for operating the system will be transmitted from Maricopa, where the power plant of the company is located.

TRUCKEE, CAL.—The Truckee Water & Light Company is erecting a new transmission line with heavier wires, preparatory to making a change in its power plant. The generator, which has been located one-half mile east of the town will be moved to the town and installed so as to work in conjunction with the power house of the Truckee Lumber Company.

NEW BRITAIN, CONN.—The contract for lighting Central Park has been awarded by the Board of Public Works to the Housatonic Power Company. The company agrees to furnish 70-watt lamps at $20 each per year.

JACKSONVILLE, FLA.—The Board of Trustees has engaged the Scofield Engineering Company, of Philadelphia, Pa., to prepare plans and supervise the construction of the new municipal electric plant to be erected on the property recently acquired on Talleyrand Avenue. The new station when completed will have an output of 7000 kw, provisions being made for future extensions. The two 500-kw units and two 1500-kw units in the present station will be utilized. The entire cost of the new plant is estimated at $375,000, but with the present equipment to be utilized, it is estimated that the city will only have to meet an actual expenditure of $280,000 in the next fourteen months.

ORLANDO, FLA.—Plans and specifications for an electric light plant, water works and sewer systems are reported to have been submitted to the committee by W. W. Lyon, civil engineer, of Jacksonville, Fla. A. L. Beck is chairman of committee in charge.

FAIRBURN, GA.—The Fairburn and Atlanta Railway & Electric Company has applied to the State Railroad Commission for permission to issue $75,000 in capital stock and $50,000 in first mortgage bonds. The company is building an electric railway from Fairburn to Union City, via College Park.

MADISON, GA.—An extensive survey of the water power of the Apalachee River has recently been made by the Apalachee Power Company, of Madison, Ga., under the direction of T. B. Johnson, engineer. It is understood that the company is contemplating the erection of a large power plant to supply electricity to towns and villages in this section.

WAILUKU, HAWAII.—Plans are being considered by the Wailuku Electric Company to install an electric light plant. It is understood that the company will only furnish electricity for lamps at first, but later will provide for power service.

WEISER, IDAHO.—The Weiser Pipe Line Company is reported to have awarded a contract for the installation of an electric pumping plant to Charles L. House, of Weiser, Idaho. Water will be pumped from the Snake River for irrigating purposes.

BROADLANDS, ILL.—It is reported that negotiations have been closed whereby C. W. Hagerman, of Villa Grove, Ill., will supply electrical service in Broadlands. Electricity will be supplied from the plant at Villa Grove. It is understood that additional machinery will be installed at the Villa Grove plant.

CARLYLE, ILL.—The contracts for construction of an addition to and equipment for the municipal electric light plant have been awarded as follows: For construction of building to W. T. Fink, of Carlyle, Ill., for $3,181, and to the Russell Manufacturing Company, of Massillon, Ohio, for machinery, including a 225-hp engine, two new boilers and generator.

CHAMPAIGN, ILL.—The Illinois Traction System, it is reported, will commence work on the construction of interurban railways out of Atchinson, Kan., next spring. It is proposed to build one line up the Kansas side of the Mississippi River, another to Leavenworth, and one to Topeka.

CLINTON, ILL.—The Mayor is reported to have appointed a committee from the City Council to make investigations in regard to using electricity instead of steam power for the municipal water works system.

DECATUR, ILL.—It is reported that the Decatur and Macon County Hospital Association is contemplating the erection of a new power house to supply electricity for the new hospital, which is to be erected in Decatur.

EAST ST. LOUIS, ILL.—Plans are being considered by the lighting committee of the City Council to install cluster lamps in the business district of the city, if satisfactory arrangements can be made with the lighting company. The city now has a contract with the Consumers' Light, Heat & Power Company, under which arc lamps are supplied at $70 each per year. The members of the Retail Merchants' Association pay the cost of the arches strung across the streets.

ELGIN, ILL.—The Elgin Traction Company has applied to the City Council for a franchise to construct and operate an electric railway in Elgin. J. P. Sayer is interested in the project.

KANKAKEE, ILL.—The Chicago, Kankakee & Champaign Electric Railway Company is reported to be contemplating the construction of a power plant at Urbana, and also one at Kankakee. George M. Bennett, of Urbana, Ill., is president.

MACOMB, ILL.—The Macomb Sheet Metal Works, of Macomb, Ill., recently incorporated for the purpose of manufacturing sheet specialties of all kinds, it is understood, will purchase machinery, including electric motors, for its paint.

MOUNT CARMEL, ILL.—J. M. Mitchell, receiver of the Mount Carmel Gas & Electric Company, is reported to have applied to the United States Court for permission to issue receiver's certificates to the

amount of $20,000, the proceeds to be used for improvements to its plant in this city. A. R. Manley is superintendent.

ROCK ISLAND, ILL.—Sealed proposals will be received at the office of the commanding officer, Rock Island Arsenal, Rock Island, Ill., until Oct. 20 for furnishing at the Rock Island Arsenal one 50-hp, 50-volt, compound-wound, double-connected motor, with pulley, slide rails and starting rheostat.

SIDNEY, ILL.—Preparations are being made for the construction of a municipal electric light plant in Sidney.

SPRINGFIELD, ILL.—Steps have been taken toward the organization of a new company for the purpose of constructing an interurban railway connecting Springfield, Cantrall, Athens, Petersburg, Sweetwater and Greenview. An appropriation of $6,000 has been made for surveys and other expenses. Homer J. Tice, of Greenview, Ill., is president of the company; George L. Harnsberger, of Springfield, Ill., vice-president, and Samuel E. Prather, secretary.

SPRINGFIELD, ILL.—The repair shops of the Wabash Railroad in Springfield are being equipped for electrical operation. Electricity for operating the machinery will be supplied by the Springfield Light, Heat & Power Company. The steam service will be discarded.

STERLING, ILL.—It is reported that the Sterling Hydraulic Company has rejected a proposition submited by J. G. White & Company, of New York, N. Y., to rent the new power station at the government dam for a period of thirty years. It was decided to make a proposition to Chester Griswold, of J. G. White & Company, that a new company be formed, consisting of the members of the present hydraulic company, to take over the new power plant, refund the money invested there by R. Griswold Wire Mill Company and pay a larger annual réntal per horsepower to the old company than that offered by J. G. White & Company.

TAYLORVILLE, ILL.—It is reported that the Taylorville Gas & Electric Company and the City of Taylorville have come to an agreement, and a resolution has been passed by the City Council granting the company a franchise for a term of twenty-five years.

TROY, ILL.—The St. Louis & Eastern Traction Company, which proposes to construct an electric railway to connect Granite City, Greenville, Troy, Highland and Pocahontas, will soon apply for a franchise to build its road through Troy. A. W. Crawford, of Hillsboro, Ill., is interested in the project.

BOONVILLE, IND.—The City Council has passed an ordinance favoring the construction of a power plant for the water works system.

EATON, IND.—The Town Council has granted the American Gas & Electric Company a franchise to construct and operate an electric system in Eaton, the service to be in operation within 18 months. The town has contracted with the company for street lighting, under the terms of which the company is to furnish arc lamps at the rate of $100 per lamp per year. Ultimately the transmission lines of the company will be extended to other towns and cities from its central power plant in Muncie. William T. Haywood, of Muncie, is attorney for the company.

EVANSVILLE, IND.—The Evansville & Eastern Electric Railway Company is reported to be contemplating the extension of its railway to New Albany, for which surveys are now being made.

EVANSVILLE, IND.—Preparations are being made by the Evansville, Mt. Carmel & Olney Electric Company for the construction of its proposed electric interurban railway to connect Evansville, Ind., Mt. Carmel and Olney, Ill., 65 miles in length. A. Knoph, of Olney, Ill., is president of the company.

FORT WAYNE, IND.——The Home Telephone Company has begun work on the erection of a new telephone line from Fort Wayne to Hicksville, Ohio.

GARY, IND.—The Indiana Steel Company, of Gary, Ind., has recently placed a contract with the General Electric Company, of Schenectady, N. Y., for a seven-panel switchboard to control 220-volt feeders in its coke oven plant. The General Electric Company will furnish the entire controlling apparatus, including four 6000, six 3000 and two 2000 amp circuit breakers mechanically interlocked in pairs on the outside legs and twelve 5000-amp lever switches. The combined feeder capacity of this switchboard is 22,000 amp at 220 volts and 25 cycles.

ONTARIO, IND.—It is reported that the Riverside Electric Company is contemplating the erection of an electric light and power plant in Ontario. W. H. Cain is president.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company has commenced work on the rebuilding of its plant in this city. The new building is being built around and over the old power house.

SULLIVAN, IND.—The new central station of the Sullivan County Electric Company is practically completed and the company will soon supply electricity to a number of surrounding towns from six to twelve miles distant.

COLFAX, IA.—F. L. Breeden, owner and manager of the Colfax electric light and power plant, has secured a franchise in Prairie City, six miles distant. A 6600-volt transmission line will be erected; the company is in the market for materials for the same. C. A. Archer is superintendent.

DES MOINES, IA.—The construction of an electric interurban railway to Red Oak is under consideration. The members of the Greater Des Moines committee are reported to have agreed to raise $200,000 for construction of the proposed railway.

LEON, IA.—The Leon Electric Company, it is reported, is extending its transmission lines to Decatur for the purpose of supplying electricity in that town.

MASON CITY. IA.—The Missouri Iron Company is reported to have entered into a contract with the Upper Iowa Power Company for electrical power. It is understood that an 800-hp turbine and a 750-kw generator will be installed at once.

CAWKER CITY, KAN.—The contract for electrical equipment for the municipal electric plant, including wire, poles, switchboard, lamps, insulators, etc., has been awarded to the Fairbanks-Morse Company.

EMPORIA, KAN.—It is stated that a franchise has been granted to Dayton, Ohio, parties for the construction of an electric street railway in Emporia. It is understood that the deal includes the purchase of the local municipal electric plant by the same parties. O. M. White, of Emporia, is chairman of the local committee.

FORT SCOTT, KAN.—The contract for the construction of the new power house of the Fort Scott Gas & Electric Company has been awarded to William Cassell, of the Fort Scott Planing Mill Company, to cost about $6,000. H. Wurdack, of St. Louis, Mo., electrical engineer, is reported to have been engaged to take charge of the installation of the plant.

HUTCHINSON, KAN.—The City Council of South Hutchinson has granted the United Water, Gas & Electric Company, of Hutchinson, Kan., a franchise to furnish electricity for street lighting in that city.

KANSAS CITY, KAN.—The Metropolitan Street Railway Company is preparing plans for the extension of its system in Kansas City, Kan.

McPHERSON, KAN.—Preparations are being made to enlarge the municipal electric light plant, including the installation of additional equipment, as follows: A 150-kw generator, Corliss engine with a rating of from 100 to 150 hp, boiler, switchboard and transformer.

PARSONS, KAN.—It is reported that the proposition to issue $50,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant, will be submitted to a vote at the general election in November.

SYLVIA, KAN.—At an election to be held soon the proposition to issue $5,000 in bonds for the construction of an electric light plant will be submitted to a vote.

TONGANOXIE, KAN.—Plans are being considered for the organization of a company to construct an artificial lake and power plant on the low lands, north of Tonganoxie. The proposed plant will furnish power to manufacturing industries in Tonganoxie.

WAMEGO, KAN.—The City Council is considering the question of increasing the output of the municipal electric light plant. It is proposed to install a 150-kw generating unit, either steam turbine or direct-connected unit. The question of furnishing approximately 50 hp to single-phase motors is under consideration. D. A. Course is superintendent of the light and water systems.

HOPKINSVILLE, KY.—Plans are being made to organize a company, to be known as the Kentucky & Tennessee Traction Company, for the purpose of constructing an interurban railway from Hopkinsville to Guthrie.

LOUISVILLE, KY.—It is reported that the J. M. Robinson-Norton Company is contemplating the construction of a power plant.

MIDWAY, KY.—At the election to be held in November the proposition to issue $6,000 in bonds, the proceeds to be used for the construction of an electric light plant, will be submitted to a vote.

EUNICE, LA.—R. Lafleur, Mayor, is reported to have recommended to the Town Council that an election be called to submit the proposition to sell the municipal water works system to the company which proposes to build an electric light plant in Eunice, to a vote.

PICAYUNE, LA.—The Ross Lumber Company, it is reported, has been granted a franchise to construct and operate an electric light plant in Picayune. It is understood that machinery for the plant has already been purchased.

BALTIMORE, MD.—Announcement was recently made by Richard B. Fentress, of the Baltimore Electric Light & Power Company, that all opposition to the development of the Fentress-Mediary lighting franchise had been withdrawn, and that arrangements would soon be made to supply electricity to consumers in Baltimore. It is stated that Mr. Fentress is prepared to spend $2,500,000 for the erection of a plant and distributing system in this city.

BALTIMORE, MD.—Robert J. McCuen, superintendent of department of lamps and lighting, has submitted a report to Mayor Mahool recommending the installation of a municipal electric light plant. He estimates the cost of such a plant, including value of real estate, transmission lines and other equipment at $909,050; the cost of maintenance, allowing for interest on investment, loss in taxes, depreciation, loss in municipal subway rentals, insurance, repairs, labor, etc., for a plant producing 6,470,779 kw at $247,606. The cost of arc lamps for street lighting is estimated at $43.29 each per year, while electricity for public buildings would be 1.9 cents per kw-hour. Under the present contract the city pays the Consolidated Gas, Electric Light & Power Company for arc lamps in the underground districts, where duct rental is charged, $75 each per year, and in the overhead districts $60.25. Electricity for the public buildings from 3 cents to 6 cents per kw-hour.

BALTIMORE, MD.—Application has been filed by the Baltimore

County Water & Electric Company with the Public Service Commission asking permission to separate the two branches of the business, the electrical portion to be operated entirely through a subsidiary company, to be known as the Batimore County Electric Company, which was incorporated under an act of the last legislature. The petition states that the property of the electrical end is worth approximately $350,000, and that the electrical company will pay the water company for the property in its own securities. Under the new arrangement the water company will furnish the new company with water and steam for the next two years under a contract which has been made subject to the approval of the commission. The electrical company is contemplating extensive improvements to its service during the next two years. The Baltimore County Water & Electric Company is a consolidation of the Catonsville Water Company and the Chesapeake Electric & Water Company and the Towson Water Company. The company practically controls the water and electric business in Baltimore County. Albert H. Wehr is vice-president and manager of the Baltimore County Water and Electric Company.

BELAIR, MD.—The electric plant of the Belair Electric Company, located on Winter's Rune, two miles distant, was destroyed by fire on Oct. 5. The company has just completed its auxiliary plant, which will be put into use immediately. It is understood that the plant will be rebuilt as soon as possible.

BOSTON, MASS.—The contract for the installation of two main steam turbine-driven centrifugal pumping units at the Calf Pasture pumping station, Dorchester, Mass., on foundations already in place, has been awarded to the Power Equipment Company, of Boston, Mass., for $36,063. L. K. Rourke is superintendent of streets.

GREAT BARRINGTON, MASS.—The New York, New Haven & Hartford Railroad Company, which has acquired the Berkshire electric railway system, has applied to the State Railroad Commission for an approval of the construction of an extension of the railway from the present terminus at Great Barrington, through Sheffield to Ashley Falls, a distance of ten miles.

HOLYOKE, MASS.—Announcement has been made by the Gas and Electric Department that the wires of the municipal electric plant will be placed underground before any further concessions in rates are allowed to consumers.

HULL, MASS.—The War Department has contracted with the Town of Hull to supply Fort Andrews, Peddocks Island, with electricity from the municipal electric plant at Whitehead. The cost of connecting the fort with the electric plant is estimated at about $10,000. Work has already commenced on laying the cable across the bay to the island.

WORCESTER, MASS.—The factory at 50 Kinsbury Street, formerly occupied by the Litchfield Cushion Heel Company, has been purchased by Dr. Julius Garst. The new owner is equipping the same for the manufacture of porch shades. The machinery will be equipped for electric motor drive.

HOUGHTON, MICH.—The Houghton Copper Company is reported to be considering the question of using electricity for hoisting and air compressing at its mines. This, it is said, will be the first use of electricity for air compression in the copper country, although the Winona and King Philip mines use electricity for hoisting. It is expected that the plant of the Houghton County Electric Light Company, which will supply the service, will be enlarged.

SAGINAW, MICH.—The City Council has adopted a resolution rescinding the franchise granted to the Chippewa Power Company in December, 1909, the company not having complied with the terms of the franchise.

CHISHOLM, MINN.—Preparations are being made by the Range Power Company for improvements to its power plant, including the installation of a new 400-hp engine.

DULUTH, MINN.—The City Council has granted the Duluth Street Railway Company a franchise to extend its railway system on Grand Avenue in Duluth to Fond du Lac. The new line will extend through Ironton, Smithville and New Duluth.

MANKATO, MINN.—It is reported that the farmers living along the transmission line from Mankato to the Rapidan dam are preparing to equip their residences and buildings for electric light and power.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company is contemplating the erection of two steel stacks at its power house in Minneapolis, to cost about $50,000.

PIPESTONE, MINN.—Preparations are being made to rebuild the local telephone exchange. The cost of the work is estimated at about $25,000.

ST. PAUL, MINN.—Surveys are being made by the St. Paul Railway Promotion Company for its proposed system of interurban railways radiating from St. Paul to Mankato, Eagle Lake, Faribault, Northfield and other southern Minnesota towns. W. L. Sontag, of St. Paul, Minn., is general manager.

MERIDIAN, MISS.—It is reported that a contract has been awarded by the Meridian Light & Railway Company for the construction of an addition to its boiler house; the company is installing a 500-hp boiler.

COLUMBIA, MO.—Extensive improvements and extensions are contemplated to the municipal electric light and water works system, for which bonds to the amount of $125,000 were recently voted. The work in connection with the electric light plant includes the erection of building and boiler plant, changing present arc lamps to magnetite system and rearrangement of the street lighting system; the installation of a 500-kw, high-pressure, steam turbine generating unit and a 250-kw generating unit.

DREXEL, MO.—It is reported that plans are being prepared by A. J. Harbison for the installation of an electric light plant to furnish electricity for lighting his property. The proposed plant will have sufficient output to supply electricity for lighting the business portion of the town.

KANSAS CITY, MO.—Plans are being prepared for the construction of a large dam for the Big Niangua Hydro-Electric Company on the Niangua River, 6 miles southwest of Linn Creek and about 120 miles from Kansas City. The proposed dam will be 160 ft. high, 1458 ft. long, of stone and concrete construction. The cost of the dam, equipment and transmission line into Kansas City is estimated at about $2,500,000. Burns & McDonald, Kansas City, Mo., are engineers; Roland E. Brunner, 914 Commerce Building, Kansas City, Mo., is interested in the company.

KING CITY, MO.—It is reported that Fred Thompson has submitted a proposition to the City Council to install an electric light plant in King City.

PLATTSBURG, MO.—The City Council has granted the Home Telephone Company, of St. Joseph, Mo., a franchise to construct and operate a common battery system in Plattsburg.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company is preparing plans for the construction of an extension of its railway system from Twenty-sixth Street to the State Hospital.

ST. LOUIS, MO.—The capital stock of the Suburban Electric Light & Power Company has been increased from $200,000 to $750,000.

ST. LOUIS, MO.—The Union Electric, Light & Power Company has recently installed an additional 12,000-kw. turbo-generator set, making 80,000 hp. The Union Electric Light & Power Company has recently placed an order with the General Electric Company, of Schenectady, N. Y., for sixteen eight-series mercury arc rectifiers for use in connection with direct-current arc lamps, each outfit consisting of panel, two tubes, constant-current transformers, exciting transformer, static discharger and direct-current reactor. Each set will take alternating current from the line at 6600 volts and 25 cycles and will rectify it to operate 75-68 series luminous arc lamps.

CHARDON, NEB.—The plant and holdings of the Chardon Electric Light & Power Company has been purchased by Messrs. Kass & Klingaman, who, it is said, will reorganize the company and enlarge the entire plant to meet the requirements of the increasing demands made upon it.

OMAHA, NEB.—The installation of an ornamental illuminating system in the business district of the City of Omaha is under consideration by the Commercial Club.

SEWARD, NEB.—Sealed bids will be received at the office of the village clerk, Seward, Neb., until Oct. 28 for furnishing material and installing an electric light and water works plant. The cost of the work is estimated at $7,000. Martz Brothers, of Seward, Neb., are engineers.

SIDNEY, NEB.—We are informed that the property of the Sidney Electric Service Company has changed hands and is now owned and operated by C. G. Leseur and A. S. Hardy. The new owners are making improvements and extensions to the plant, including the installation of a new Frost boiler, a Skinner engine and a 35-kw generator, direct-connected. An addition is also being erected to the power house. C. G. Le Seuer is president of the company; A. S. Hardy, vice-president, and C. B. Hardy, secretary and treasurer.

BAYONNE, N. J.—The Smith & Cox Company, of Bayonne, N. J., recently incorporated to manufacture all kinds of pipes, tube bends and coils of all descriptions, is reported to be receiving bids for equipment of its plant. The company will require, in addition to power equipment, electric and gas lamps, heating plant, electric welding machinery, threading machinery, welding apparatus, cutting machinery, etc. For further information address J. Fillmore Cox, Twenty-sixth Street and the Boulevard, Bayonne, N. J.

TRENTON, N. J.—Announcement has been made by the Public Service Corporation that it will place lamps in Hamilton Township wherever it has gas or electric conduits. Lamps will be erected on East State, Greenwood, Johnson, Norway, Robert Streets, Whitehead Road and Victor Park Lane.

UNION, N. J.—The Public Service Corporation of New Jersey is contemplating building a new electric railway on Stuyvesant Avenue in Union, for which an application for a franchise will soon be made.

BUFFALO, N. Y.—The Beaver Company, of Buffalo, N. Y., is reported to be erecting two additions to its plant at Black Rock, Buffalo. It is understood that the company will be in the market for electric motors.

LANCASTER, N. Y.—Plans have been prepared by the New York Telephone Company for placing its wires underground on the principal streets in Lancaster.

NEW YORK, N. Y.—Sealed bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 12 for furnishing and installing one electric motor-driven capstan at the United States Navy Yard, New York, N. Y. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. R. C. Hollyday is chief of bureau.

NEW YORK, N. Y.—Bids will be received until Nov. 3 by the Park Board, at the office of the Department of Parks, Arsenal Building, Fifth Avenue and Sixty-fourth Street, New York, N. Y., for furnishing and installing electric lighting fixtures in the Metropolitan Museum of Art, New York, N. Y. Plans may be seen and blank forms obtained at the above office. Charles B. Stover is president of park board.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov 3, for an electric elevator equipment at the new United States post office building, New York, N. Y., in accordance with plans and specifications, copies of which can be obtained at the above office, or at the office of McKim, Mead & White, 160 Fifth Avenue, New York, N. Y. A deposit of $100 will be required to insure return of plans and specifications. James Knox Taylor is supervising architect.

NEW YORK, N. Y.—Sealed bids will be received by Henry S. Thompson, commissioner of Department of Water Supply, Gas and Electricity, Room 1904, Park Row Building, New York, N. Y., until Oct. 20 as follows: Section 1—For furnishing and installing electric control cables in underground ducts, from the South Street high-pressure pumping station to the gate valve vaults in New Chambers Street, east of the Bowery, and in East Houston Street, east of the Bowery. Section 2—For furnishing and installing motor-operated gate valve, subsidiary ducts, etc., with all appurtenances complete in the high-pressure fire service mains in New Chambers Street, east of the Bowery, and in East Houston Street, east of the Bowery. Bidders are requested to make their bids on blank form prepared by the department, copies of which can be obtained on application to the above office.

SENECA FALLS, N. Y.—Negotiations have been closed between the Village of Seneca Falls and the Geneva-Seneca Electric Company whereby the village will secure a better distribution of lamps and an all-night service, to take effect Dec. 1, 1910. Under the present contract there are about eighty arc lamps and twenty-five incandescent lamps of 25 cp. Under the new contract the company will supply twenty arc lamps at $70 each per year and 267 incandescent lamps at $18 per lamp per year. per year.

SYRACUSE, N. Y.—Plans are being prepared by the New Central Railroad Company to equip the Auburn Railroad between Syracuse and Geneva, a distance of fifty-four miles, for electrical operation. The third-rail system will be used. The cost of the work is estimated at $1,000,000. It is expected to have electric trains running between Syracuse and Geneva in time for the State Fair next year.

UTICA, N. Y.—The new mill of the Frisbe & Stansfield Knitting Company, to be known as Richelieu Mill No. 2, has been completed. The new building is 154 ft. x 54 ft. and is equipped for electric motor drive. An electric power plant will be installed in an adjoining building. The equipment will include a 150-hp boiler, engine, generator and transformer.

WILSON, N. Y.—Plans are under consideration for the construction of an electric railway to extend from the New York Central Railroad station in Wilson to Lake Island Harbor and Sunset Beach, a distance of about 2 miles. S. M. Conant, president of the Conant-Bryant Company, which supplies electricity for lighting the village, is interested in the project.

GREENSBORO, N. C.—The Town Council has accepted the proposition of the North Carolina Public Service Corporation for lighting the streets of the town, under the terms of which the company is to supply 175 arc lamps at $58 each per year and 80-cp tungsten at $20 per lamp per year, for a period of ten years. Work on the installation of the new lamps will begin at once.

GREENSBORO, N. C.—The Southern Power Company has secured a site in the heart of Greensboro to be used for its passenger and freight terminals upon the completion of the interurban railway from Anderson and Greenville, S. C., 200 miles in length. The company has commenced work on the excavation for its reservoir in connection with its auxiliary steam plant to be erected in this city at a cost of about $300,000. It is reported that the interurban railway, which is operated largely by the Southern Power Company interests, has made arrangements to utilize 110 miles of tracks of the Seaboard Air Line, from Rutherford, 85 miles west of Charlotte, to Monroe, 25 miles east of Charlotte. It is understood this will be a cross line of the interurban, as the main railway, it is assumed, will pass directly through Charlotte. The railway will eventually extend to Raleigh and possibly to the coast.

MORGANTON, N. C.—J. D. Pitts, of Glen Alpine, N. C., is reported to have commenced work on the construction of a dam and electric plant on Canoe Creek, about four miles above Morganton, where about 250 hp will be developed, at a cost of about $20,000. The plant will furnish electrictiy in Morganton and Glen Alpine.

MURPHY, N. C.—The plant and holdings of the Cherokee Telephone Company, of Murphy, N. C., have been purchased by the Southern Bell Telephone Company, including 100 miles of telephone line, throughout the extreme western and mountain part of North Carolina and Georgia.

WADESBORO, N. C.—The Wadesboro Telephone Company is reported to be contemplating rebuilding its entire system, including the erection of new poles, wires, switchboard, etc.

BELLEFONTAINE, OHIO.—The Big Four Railroad is reported to be considering the installation of a new central power plant at its shops in Bellefontaine.

CLEVELAND, OHIO.—A permit has been granted to the Chandler & Price Company for the construction of a factory and power plant at Cedar Avenue and C. & P. tracks to cost $60,000. The company manufactures printing presses.

CLEVELAND, OHIO.—It is reported that plans have been prepared by W. S. Lougee, architect, for the construction of a large warehouse for wholesale groceries and a factory building for the William Edwards Company. The equipment of the power plant, it is said, will include two 500-hp boilers, engine, generators and motors for operating six elevators, driving printing presses and other machinery.

COLUMBUS, OHIO.—Charles Kircher, of Athens, Ohio, is reported to have secured the contract for the construction of the power house at the State University.

YOUNGSTOWN, OHIO.—Preparations are under way for the construction of an electric railway between Painesville and Youngstown, for which right-of-way has been secured. J. R. Curtis and George H. Carpenter are interested in the project.

YOUNGSTOWN, OHIO.—In a report submitted to the City Council by J. B. Meriam, an engineer of the Bruce Macbeth Engine Company, of Cleveland, Ohio, in connection with the installation of a municipal electric plant to supply electricity for the proposed new lighting system of 150 lamp standards. The cost of installing the plant is estimated at $35,450 and an annual maintenance expense of $6,625, which includes labor, fuel, interest at 6 per cent and depreciation at 8 per cent, making the cost per lamp standard equivalent to $44 per year, against $64.50 offered by the Youngstown Consolidated Gas & Electric Company, which would result in a saving of $3,075 a year. It is proposed to locate the plant in the basement of the market house in Boardman Street and the equipment would include two 100-kw generators, engines, underground conduits and the entire expense of installing the system, with the exception of the pedestals, which are to be furnished by the Merchants' Association. The plant will be capable of taking care of 150 additional lamp standards, making 300 in all.

SALLISAW, OKLA.—Bonds to the amount of $16,000 are reported to have been voted, the proceeds to be used for extensions to the water and electric light service.

PORTLAND, ORE.—The East Side Business Men's Club is reported to have adopted a plan for the installation of an ornamental illuminating system in the center district of East Portland. It is expected to have the lamps in place before winter.

PORTLAND, ORE.—The Mount Hood Railway & Power Company is reported to have engaged Smith, Kerry & Chase, of Toronto, Ont., to supervise the construction of its power plant at the confluence of the Bull Run and Sandy rivers. The proposed plant will supply electricity to operate the railway of the company and for other purposes.

CHAMBERSBURG, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 16, for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office building at Chambersburg, Pa., in accordance with plans and specifications, copies of which may be obtained from the custodian of site at Chambersburg, Pa., or at the above office. James Knox Taylor is supervising architect.

COLUMBIA, PA.—The construction of an electric railway from Dover to New Oxford is reported to be under consideration, for which surveys have been made. The road is operating from York to Dover, and it is understood that it is proposed to build a connecting link with the railway from McSherrystown to New Oxford, making a circuit from Spring Grove, Hanover, McSherrystown, New Oxford, East Berlin and Dover.

DILLSBURG, PA.—The Dillsburg Light, Heat & Power Company has applied for a charter for the purpose of supplying electricity in Dillsburg. It is reported that the company is planning to erect a 200-kw hydro-electric plant on the Yellow Breeches Creek.

NORTH YORK (P. O. YORK), PA.—The Council is reported to have granted the North York Electric Light Company permission to construct and operate an electric lighting system in this borough.

PITTSBURGH, PA.—It is reported that preliminary arrangements are being made for the construction of an electric railway to connect Pittsburgh, Wellsburg and Wheeling. H. M. Rodgers and C. B. Reeves are interested in the project.

SCRANTON, PA.—Plans for equipping for electrical operation a portion of the Delaware, Lackawanna & Western Railroad, on what is known as its "pusher" service from Lehigh to Clarks Summit, have been approved by President Truesdale of the company. About twenty-three miles of the railroad will be euipped for electrical operation.

FLORENCE, S. C.—Extensive improvements are being made to the plant of the Florence Electric & Utility Company, which, when completed, will more than double the output of the plant. This company is successor to the Florence Light & Power Company.

NEWBERRY, S. C.—The new mill of the Oakland Manufacturing Company will soon be completed. The factory will be equipped for electric motor drive, electricity for which will be supplied by the Southern Power Company. William H. Hunt, of Newberry, is president of the company.

YORKVILLE, S. C.—Owing to the report that the Southern Power Company, which now supplies electricity for operating the municipal electric plant, proposes to increase its rate from 1 cent per kw-hour to 1.9 cents per kw-hour, the town is considering the question of installing

a complete generating plant. The municipality owns the equipment and distributing system, the Southern Power Company supplying energy for operating the same. The five-year contract with the company will soon expire.

ERWIN, TENN.—Ladshaw & Ladshaw, of Spartanburg, S. C., are reported to have prepared plans for the Nolachucky Power Company for the construction of a hydroelectric power plant on the Nolachucky River. W. C. Heath, of Monroe, N. C., is president of the company.

MEMPHIS, TENN.—Plans are being made by the Memphis Street Railway Company to construct and operate a double-track railway on Cleveland Street in Memphis.

NASHVILLE, TENN.—The Louisville & Nashville Railroad Company is reported to have decided to equip its line from Cincinnati, Ohio, to Birmingham, Ala., with telephones for train dispatching, which will cover the Cumberland Valley and Kentucky divisions from Cincinnati to Norton, including 304 miles, the equipment to consist of four train wires and two message circuits, with 162 stations.

AUSTIN, TEX.—N. A. Dawson, of San Antonio, Tex., and associates, who were recently granted a franchise by the City Council for the construction of an electric street railway in South Austin and through portions of Austin, have made a voluntary bond to the city to the amount of $20,000 that they will complete not less than two and one-half miles of track within one year.

AUSTIN, TEX.—Negotiations for the transfer by the Dumont-Holmes Steel Concrete Construction Company of its contracts for the reconstruction of the large dam across the Colorado River at Austin to the Hydraulic Properties Company, of New York, N. Y., are said to be practically completed. The Board of City Commissioners of Austin does not object to the transfer being made. Announcement has been made by the representatives of the Hydraulic Properties Company that work will soon commence on the construction of the dam and hydroelectric plant. It is proposed to erect a dam 65 ft. in height.

BROWNSVILLE, TEX.—The City Council is reported to be considering the question of calling an election to vote on the proposition to issue $50,000 in bonds, the proceeds to be used for the installation of additional street lamps, extensions to water mains, etc.

FORT WORTH, TEX.—It is reported that extensions to the street lighting system are being considered by the City Council. Charles F. Crabtree, chief electrician, has submitted a report to Commissioner Powell, calling for 250 additional arc lamps and 800 75-watt tungsten lamps.

LEAGUE CITY, TEX.—It is reported that the Galveston-Houston Electric Company has decided to locate its main power plant on Clark Creek, about one-half mile distant from this city. The power house will be 70 x 100 ft. and the equipment will include three 520-hp boilers, one 1100-kw and one 500-kw turbo-generator, with necessary condensers, water heaters, feed pumps, air compressor, etc. Electricity will be generated at 2300 volts and stepped up to 3300 volts for transmission to three substations, for which locations have not yet been decided upon. At the substations power will be stepped down to 2300 volts and delivered to motor generators supplying direct current at 600 volts for railway service. Mark Lowd, of Houston, Tex., is southwestern manager for the Stone & Webster Corporation, Boston, Mass., which has charge of the work.

NEW BRAUNFELLS, TEX.—The construction of a dam across the Guadalupe River, near New Braunfells, in connection with a hydroelectric power plant, is under consideration. Adolph Henne, of New Braunfells, and others are interested in the project.

PARIS, TEX.—The City Council is considering the question of constructing combined electric light and water works plants; the electric plant to have sufficient output to provide for 300 lamps of 2000 cp and the water works to have a daily capacity of 1,000,000 gallons per day. An election will be held within a few months to vote on the proposition. E. H. McCuiston is Mayor.

TEXAS CITY, TEX.—The Texas City Company is reported to be contemplating the construction of an electric light plant in Texas City. A. B. Wolvin, of Duluth, Minn., is president.

BRIGHAM CITY, UTAH.—The report of the electric light committee on its investigation of enlarging the municipal electric plant in Box Elder Canyon estimates the cost of installing an additional generating unit at $7,814 and $800 for an addition to the power house. The committee asked for authority to make further investigations, which was granted.

OGDEN, UTAH.—Notice of appropriation of 50 cu. ft. of water of Paradise Creek in Cache County has been filed by H. C. Baker and H. J. Craven, of Ogden, Utah, to be used for power purposes. It is proposed to erect an electric plant and distribute electricity for lamps and motors throughout Box Elder and Cache counties.

SALT LAKE CITY, UTAH.—It is reported that the question of equipping the Salt Lake-Nephi branch of the Salt Lake Route is under consideration. If it is decided to equip that branch for electrical operation, the interurban line of the street railway will not be extended beyond Sandy. The building of a railway west of Midvale and south on the Redwood Turnpike has been abandoned.

TOOELE, UTAH.—Notice of appropriation of water from Settlement Canyon, in Tooele County, has been filed by A. F. Doremus, of Salt Lake City, Utah, with the state engineer. The water will be carried down the canyon in the mains of the Clark Electric Company as far as its plant, where it will be piped into Tooele City, to be used for domestic purposes.

EMPORIA, VA.—The Emporia Manufacturing Company has changed the driving power of its plant from steam to electricity. Power for operating the works is supplied by the Emporia Hydro-Electric Corporation, which has entered into a ten-year contract with the Emporia Manufacturing Company to supply the same. The hydroelectric company also supplies electricity for street lighting and other industries in Emporia.

FOSTER FALLS, VA.—The Foster Falls Company, recently incorporated with a capital stock of $100,000, is contemplating the construction of a hydroelectric power plant at Foster Falls, on New River. It is estimated that from 3,000 to 4,000 hp can be developed, which will be utilized to operate the mining plants of the Virginia Coal & Coke Company, of Bristol, Va. Henry K. McHarg, 40 Wall Street, New York, N. Y., is president; John B. Newton, vice-president, and John W. Cune, secretary and treasurer, both of Roanoke, Va.

HUNTERS, WASH.—M. W. Thompson, who recently purchased the local electric light plant, has secured water rights on the upper Hunters Falls, and has also leased a site from J. B. Cameron, and will transfer the plant to the falls. Electricity generated at the plant will be utilized to pump water from the Columbia River and for lighting purposes in Hunters.

PULLMAN, WASH.—Arrangements are being made by E. A. Bryan, president of the State College, also president of the Riveria Company, which owns 300 acres on Snake River, for the erection of a transmission line from Starbuck to the Riveria tracts.

SEATTLE, WASH.—The controlling interest in the Independent Telephone Company, of Seattle, which was formerly owned by Youngstown, Ohio, capitalists, has been sold to New York parties.

SEATTLE, WASH.—The first of the improvements to be made by the Hannaford Irrigation & Power Company, it is said, will be the deepening of the main power canal for about a mile above Priest Rapids, work on which will begin at once. The cost of the work is estimated at about $200,000.

SEATTLE, WASH.—The contract for furnishing the lighting department of the City of Seattle with incandescent lamps amounting to $60,000 has been awarded to the Novelty Incandescent Lamp Company.

SPOKANE, WASH.—Preparations are being made by Stoolfire Brothers, owners of the Arlington mine, at Ruby, for the installation of a power plant on the property.

SPOKANE, WASH.—Plans have been prepared by the Inland Empire Paper Company for the construction of a dam across the Spokane River at a cost of about $350,000. Work on construction of the dam will commence at once. W. A. Brazeau is manager of the company.

TRINIDAD, WASH.—Surveys are being made by the Entait Light & Power Company for its proposed transmission line which will supply electricity for lamps and motors and for irrigation plants on the river. The transmission line will be extended to Ephrata.

HUDSON, WIS.—The Clifton Light & Power Company, of Hudson, Wis., has been authorized by the State Railroad Commission to issue 750 shares of capital stock at $100 per share, to be issued at not less than par, and $25,000 in bonds, the proceeds of both stock and bonds to be used for extensions and improvements to its property, including the purchase of real estate and flowage rights, pole line and right of way for the erection of a dam, in connection with a hydroelectric plant for the distribution of electricity; also for the purchase of an existing pole line, extending from the site of the proposed power plant to the Village of Prescott, and for the purchase of the electric light and power plant in Prescott; the funds are also to be used for the construction of the main power plant to be located in the Town of Clifton, Wis., and for the erection of a transmission line from the proposed power plant to the city limits of Hastings, Minn., and for the erection of a substation at that point.

MERRILL, WIS.—The local telephone system, owned by the Merrill Telephone Company, has been purchased by the Wisconsin Telephone Company. W. E. Thielman is local manager.

NEW GLARUS, WIS.—Plans are being considered for enlarging the municipal electric light plant.

WAUSAU, WIS.—The City Council is reported to have adopted an ornamental street lighting system to be installed on the main business streets of the city, which later will be extended to the residence sections. About 100 lamp standards will be installed at first.

SHERIDAN, WYO.—Preparations are being made by the Sheridan Railway & Light Company for the construction of its proposed interurban railway to extend from Sheridan to the government reservation, thirteen miles in length, work on which will begin in the near future. Ernest Boehme, of Sheridan, Wyo., is engineer in charge.

BARKERVILLE, B. C., CAN.—Preparations are being made by the Barkerville Willow River Company for the survey for an electric railway down the Willow River to the Grand Trunk Pacific Railroad, at or near Fort George, a distance of 120 miles.

NEW WESTMINSTER, B. C., CAN.—The construction of an electric interurban railway between New Westminster and Ladner, B. C., is reported to be under consideration by the Board of Trade of this city and of Ladner.

QUESNELL, B. C., CAN.—The installation of an electric light and power plant in Quesnell is reported to be under consideration. The

proposed plant will be operated by steam. Wallace McMullan and others are said to be interested in the project.

WINNIPEG, MAN., CAN.—The Manitoba Government Telephone Commission has awarded the contract for the construction of the new St. John's exchange to be erected at the corner of Salter Street and Burrows Avenue to J. M. and J. J. Kelly. The cost of the building is estimated at $38,000. The new exchange will provide for 10,000 lines and will serve all patrons north of the Canadian Pacific Railroad.

HALIFAX, N. S., CAN.—The East Pubnico Amusement Company, recently granted a charter, is planning to construct and operate an electric railway from Halifax to the amusement park at East Pubnico, four miles in length, for which surveys have been made and rights of way secured. The company, it is said, will erect a power house on Grafton Street and a substation on Albermarle Street, Halifax. It is understood that work will begin at once on construction of the road. Daniel Hawksmarth is president of the company and G. C. McClure, chief engineer, both of Halifax.

TORONTO, ONT., CAN.—Contracts have been awarded by the Board of Control for equipment in connection with Toronto hydroelectric system as follows: For storage batteries to Chapman & Walker Company, at $2,870; to the Canadian General Electric Company for transformers, for $15,800; for motor generator sets to the Lancashire Dynamo & Motor Company, at $2,262.

GUANAJUATO, MEX.—The Guanajuato Power & Electric Company is extending its transmission lines to San Luis Potosi, which will soon be completed, where it has a contract to supply electricity for lamps and motors for the large smelter of the American Smelting & Refining Company and other large industrial plants. The company has recently erected a transmission line to the San Felipe mining district, where it will furnish electricity for operating the machinery in the mill and mines of the Providencia San Juan de la Luz and other mines.

MEXICO CITY, MEX.—The installation of two additional generating units at the Necaxa plant of the Mexican Light & Power Company will soon be completed. Each of the generators now being installed has a rating of 12,500 kw and will increase the total output of the company to about 90,000 hp.

PACHUCA, MEX.—The Compania Minera Santa Ana y Anexas, of Pachuca, has equipped its mines and mill for electrical operation throughout. Electricity for operating the machinery is furnished by the Compania Electrica e Irrigadora, a subsidiary company of the Mexican Light & Power Company.

PACHUCA, MEX.—The Compania Electrica e Irrigadora, a subsidiary of the Mexican Light & Power Company, has contracted with the Compania Minera Santa Ines Carretera to supply electricity for operating the machinery at its mines, located near Pachuca. The mining company has also installed an electric hoist.

POZOS, GUANAJUATO, MEX.—The Compania Minera Augustias y Anexas has recently installed an electric power plant at its mines, located near Pozos. The plant will supply electricity to operate the pump and machinery in the mines.

SANTA ROSALIA, CHIHUAHUA, MEX.—The Mexican Northern Power Company, which is erecting a large hydroelectric power plant on the Conchos River, nineteen miles from Santa Rosalia, has enlarged upon its original plans. Announcement has been made that plans have been adopted by the company which will call for an expenditure of about $20,000,000 in gold, one-half of which will be used in the construction of the large dam across the Conchos River and the installation of an electric power plant and transmission system; the remainder will be expended for the construction of a large irrigating system. The initial output of the power plant will be 40,000 hp, which will later be increased to 90,000 hp. Transmission lines will be extended to Chihuahua, to the mining camps of Santa Eulalia, Santa Barbara, Jiminez, and to the town and mining district of Parral. It is stated that tentative contracts have been made for the full amount of power that the initial installation will provide for. In order to provide means for transporting the material for the dam and hydroelectric plant a railroad, nineteen miles in length, has been built from Santa Rosalia to the site of the dam. S. Pearson & Son have the contract for construction of the plant.

SAN SEBASTIAN, JALISCO, MEX.—The El Tajo Mining Company has recently installed a hydroelectric power plant on its property near San Sebastian to supply electricity to operate the machinery in its mill and mines.

New Industrial Companies.

THE BLACK & DECKER MANUFACTURING COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $25,000 by J. Bannister Hall, Jr., 609 Calvert Building, Baltimore, Md.; John H. Stanford and Alonzo G. Decker.

THE COMMERCIAL ELECTRIC MOTOR MANUFACTURING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture small electric motors and specialties. The office and factory will be located at 222-224 South Canal Street, Chicago. C. V. Mowat is vice-president and secretary, and Charles Endorf, Jr., treasurer and manager.

THE DOMINION WIRELESS TELEGRAPH & TELEPHONE COMPANY, of Windsor, Ont., Can., has been chartered with a capital stock of $40,000 for the purpose of dealing in electrical goods and other supplies.

THE ELECTRICAL IMPROVEMENT COMPANY, of Nyack, N. Y., has been incorporated by William B. Brewster, of Orange, N. J.; Frank J. V. Beck, 167 Gates Avenue, Brooklyn, N. Y., and George H. Schubert, 53 Parkhurst Street, Newark, N. J. The company is capitalized at $100,000 and proposes to manufacture and deal in electrical and mechanical devices and maintain a laboratory for perfecting apparatus.

THE ELGIN WHEEL & ENGINE COMPANY, of Elgin, Ill., has been incorporated by Herbert L. Thompson, Nelson W. Johnson and C. F. Trehune. The company is capitalized at $30,000 and proposes to manufacture engines and machinery.

THE ELKHART MANUFACTURING COMPANY, of Elkhart, Ind., has been incorporated with a capital stock of $25,000 by Walter Brown, Harvey H. Alberts and Horace S. Hubbard. The company proposes to manufacture and deal in electrical and mechanical devices and appliances.

THE GOLDSBOROUGH COMPANY, of Portland, Maine, has been incorporated with a capital stock of $1,500,000 for the purpose of doing a civil, mechanical, electrical, mining and irrigating engineering and construction business. The officers of the company are: T. L. Croteau, president, and A. F. Jones, treasurer, both of Portland, Maine.

THE INTERNATIONAL ELECTRIC WELDING COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 as electricians, engineers, etc., by E. D. Loughman, V. H. Downes, of New York, N. Y., and J. S. Darcy, of Brooklyn, N. Y.

THE NATIONAL TIME SWITCH COMPANY, of South Bend, Ind., has been chartered by N. C. Morrison, E. L. Betts and Carl Lindwald. The company is capitalized at $25,000 and proposes to manufacture electrical time switches, mechanical time switches, electric motors, dynamos and other electrical supplies.

THE W. H. MICKLEY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $2,000 as electrical engineers, machinists, tool makers, founders; also to manufacture machinery of all kinds. The incorporators are: John C. Quinn, William G. Austin, 39 Cortlandt Street, New York, N. Y., and William H. Mickley, 19 Thames Street, New York, N. Y.

THE RICE & GREEN ELECTRIC COMPANY, of Hartford, Conn., has been chartered with a capital stock of $10,000 by Willard A. Rice, Alfred W. Green and Harold C. Green. The company proposes to manufacture and deal in electric lighting and heating apparatus, etc.

THE WEBB MOTOR FIRE APPARATUS COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $1,500,000 and the incorporators are: C. H. Dawes, G. B. Arnold, of St. Louis, Mo., and E. B. Waples, of Wilmington, Del.

New Incorporations.

EATON, IND.—Articles of incorporation have been filed for the Eaton Electric Company with a capital stock of $10,000. The company proposes to generate and distribute electricity for lamps, heat and motors to towns and cities in this vicinity. The principal operating office will be located in Eaton and business office in Muncie, Ind. The directors are: Frank B. Ball, R. E. Breed, Frank B. Hunter, H. L. Lindley and A. L. Melton.

MINOT, N. D.—The Farmers' Co-operative Telephone Company has been incorporated with a capital stock of $50,000 by D. E. Kidder, C. G. Richards and others, of Minot, S. D.

STILLWATER, OHIO.—The Stillwater Telephone Company has filed articles of incorporation with a capital stock of $5,000. A. Dornberger and others are incorporators.

HARRISBURG, PA.—Charters have been granted by the State Department to the Hughestown Electric Company, the Dupont Electric Company, West Pittston Electric Company and the Pittston City Electric Company, of Pittston, Pa., each having a capital stock of $5,000.

HARRISBURG, PA.—Articles of incorporation have been filed for the Interborough Electric Company. The company is capitalized at $1,500,000 and proposes to take over all the electric plants in the Beaver and Ohio River valleys, and has secured all the electric lighting plants from Rochester to Sewickley, Pa., giving it control of all lighting and power privileges for 100 miles along the Ohio River and upper Ohio Valley.

HARRISBURG, PA.—Charters have been issued by the Secretary of State to the companies in the western part of Pennsylvania as follows: The Aliquippa Electric Company, of Aliquippa, Pa.; the Haysville Borough Electric Company, Moon Township Electric Company, Leet Township Electric Company, Harmony Township Electric Company, Hopeville Electric Company, West Side Electric Company, Sewickley Heights Electric Company, Sewickley Township Electric Company, all of Ambridge, Pa. Each company is capitalized at $5,000 and the incorporators are: John Read Miner, C. A. White, C. H. Kennedy and Julius Theobald, of New Brighton, Pa., and E. S. Wheeler, of Pittsburgh, Pa.

WILKES-BARRE, PA.—The Wilkes-Barre & Luzerne Street Railway Company has been chartered with a capital stock of $6,000 for the purpose of building an electric railway in Kingston. The directors are: E. L. Hessler, president; Don A. Gilbert, F. J. Northcote and John A. Stenger, of Wilkes-Barre, Pa.

Personal.

MR. VAL. A. FYNN has returned to St. Louis, Mo., after a visit of several months in Europe.

MR. MORRIS MOSKOWITZ, the pioneer inventor in electric train lighting, has resigned his connections with the United States Light & Heating Company, New York.

MR. AUGUST BOISSONNAS, electrical engineer, of Geneva, Switzerland, is in this country for the purpose of visiting electric generating plants operating under various conditions.

MR. W. E. NOURSE, for the past six years with the Boston Edison Company, has accepted a position with the Cutler Hammer Manufacturing Company, of Milwaukee, with headquarters at the Boston office, 176 Federal Street.

MR. R. NAKASHOJI, vice-minister of the department of communication of Japan, who has been studying European telephone and telegraph systems for the past four months, is visiting this country to investigate the American systems.

MR. WILLIAM T. DONNELLY will present a paper on the evening of Oct. 13 before the Brooklyn Engineers' Club at the Brooklyn Engineers' Club House entitled "Electrification of the works of the John H. Robins Company, Erie Basin, Brooklyn."

MR. RALPH E. MOORE has been appointed assistant district manager of the General Electric Company at Philadelphia. Mr. Moore has heretofore been manager of the railroad department of the company in the same territory. He succeeds the late Theodore P. Bailey.

MR. JOHN J. SCHAYER has resigned as manager of the Commonwealth Edison Company's electric shop in Chicago to accept a joint position with that company and the Automobile Maintenance Company to create an increased use of electric traffic wagons in Chicago.

MR. WALTER S. RODMAN, formerly instructor in electrical engineering at the Rhode Island College, who has been following a postgraduate course at the Massachusetts Institute of Technology for the past two years, is now adjunct professor of electrical engineering at the University of Virginia.

MR. W. R. BONHAM has been appointed manager of the Chicago office of the Triumph Electric Company, which has been removed from the Manhattan Building to 275 La Salle Street. Mr. Bonham succeeds Mr. F. L. Merrill, who is now connected with the Cosmopolitan Electric Company, of Chicago.

MR. GEORGE B. JOHNSON, formerly in charge of the special industries branch of the contract department of the Commonwealth Edison Company, has been appointed manager of electric shop of that company, reporting to Mr. John F. Gilchrist, assistant to the president, and succeeding Mr. John J. Schayer, resigned.

DR. W. H. TOLMAN, who has been making a study of recently adopted methods and devices in Germany for the elimination of danger to employees in industrial plants, has returned to this country. Dr. Tolman served as chairman of the American delegates to the International Conference on Social Insurance at The Hague.

MR. D. McFARLAN MOORE lectured before the Franklin Institute on Sept. 21, his subject being the "Progress of Vacuum-Tube Lighting." A demonstration was given of the tube lamps containing carbon dioxide gas, which provides a light showing excellent spectum analysis, which Mr. Moore has been developing for use by color workers.

MR. H. E. HEATH has recently moved his offices to 1328 Broadway, New York. After over twenty years' experience with the Eddy Electric Manufacturing Company, the General Electric Company, the Baker Electric Company and in other fields, he entered into consulting work in which he has been engaged for some time, and more recently in New York City.

Obituary.

MR. WILLIAM M. STEWART, division equipment superintendent of the New York Telephone Company, died suddenly on Oct. 5 at his home in Westfield, N. J., in his fifty-fifth year of age. Mr. Stewart has been in the service of the New York Telephone Company for the past twenty years. During this period he supervised the construction of many new central offices, and did much to develop the telephone service to its present high efficiency. He was a member of the Telephone Society of New York and of the New York Electrical Society. He is survived by his wife and son.

Trade Publications.

WIRING DEVICES.—The Pettingell-Andrews Company, Boston, has issued a 120-page catalog containing illustrations and price lists relating to the various wiring devices manufactured by the Bryant Electric Company and the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Attention is called to the fact that all of the devices shown in the catalog have either been approved by the Underwriters' Laboratories or are being tested with that object in view.

HYDRAULIC TURBINES.—Bulletin No. 101 of S. Morgan Smith Company, York, Pa., is a handsome pamphlet of fifty-two pages giving illustrations and data of Smith hydraulic turbines. Among the engravings are excellent views of a number of large hydroelectric equipments, some of which have not yet been described in the technical press. Of particular interest to electrical engineers are views and data of hydroelectric equipments for the Connecticut River Power Company; Chattanooga & Tennessee River Power Company; Roosevelt Salt River plant, Great Falls (Mont.) Water-Power Company; Winnipeg Electric Railway Company and La Crosse Water-Power Company. Another bulletin recently issued by the same company illustrates and describes head-gate hoists.

BUSINESS NOTES.

KIEWERT COMPANY.—The Chicago office of the Charles L. Kiewert Company, maker of flaming arc lamps, has been removed from 110 South Clinton Street to 58 Plymouth Place (Manhattan Building). Mr. H. W. Fowzer is in charge.

THE COLONIAL SIGN & INSULATOR COPANY, South Akron Ohio, has announced that a patent covering its "Colonial" pot-head has been issued as No. 969,816, granted to Messrs. H. L. Wallan and E. E. Noble on Sept. 13, 1910.

MASSACHUSETTS CHEMICAL COMPANY.—Mr. Charles A. Baldwin has been appointed manager of the New York office of the Massachusetts Chemical Company to succeed Mr. Henry E. Cozzens, who has resigned to enter other business.

THE SCOFIELD ENGINEERING COMPANY, Philadelphia, Pa., has been retained by the Browning Manufacturing Company, Cleveland, Ohio, to design and supervise the construction of a cantilever material handling bridge, which is to be built near Lockport, N. Y.

RIDGWAY ISOLATED PLANT EQUIPMENT.—The Schoenbrun Building, a large building for manufacturing purposes at West Adams and Peoria Streets, Chicago, now nearing completion, will be equipped with a private power plant. Conspicuous in this installation will be one 60-kw generating unit and one of 100 kw, built by the Ridgway Dynamo & Engine Company, will consist of 250-volt direct-current generators directed-connected to single-valve side-crank engines. Mr. C. Hartman, of Chicago, is the consulting engineer who designed the plant.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 4, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

971,515. MACHINE FOR MANUFACTURING INCANDESCENT LAMPS; G. W. Beadle, East Orange, N. J. App. filed Nov. 22, 1909. For shaping the anchors for filament supports, including a rotatable member and a reciprocating mandrel and a reciprocating marking device for marking the voltage data on the lamp at the same time that the anchors are being formed.

971,525. RESISTANCE COIL; I. E. Coffey, Lawton, Oklahoma. App. filed Oct. 12, 1908. For induction coils, including a pair of cores connected by yokes, a plurality of wires wound thereon and arranged side by side with binding posts at each end.

971,572. TELEGRAPH-KEY; F. G. Slemmer, Goldsboro, Md. App. filed Aug. 18, 1909. For working two circuits, breaking one and making the other by means of a pair of contacts and a second pair of contacts with manual means for closing the first contacts, the second pair being closed when the first are opened.

971,574. ELECTRICALLY-OPERATED AGRICULTURAL IMPLEMENT; C. Taurman, Cincinnati, Ohio. App. filed Dec. 30, 1909. A laterally movable trolley line, supported by portable towers mounted on wheels with a truck carrying agricultural implements and trolleys, electric motors on the truck, one of the trolley poles telescoping.

971,597. BATTERY TANK SYSTEM; F. A. Decker, Philadelphia, Pa. App. filed Jan. 10, 1910. For charging and draining batteries, particularly when used with automobiles, the tank being pivoted to the vehicle and communicating with the battery so that the liquid may be drained into it and the tank operated to discharge the liquid.

971,598. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Aug. 10, 1903. Complete metallic circuit and central energy system, avoiding the use of grounded circuits, supplied by a common battery, provided with a line signal, a supervisory lamp and relay and connections for supplying current to the lamp, through the talking conductor with a listening key for disconnecting lamp and relay from the circuit.

971,619. INSULATOR; J. T. Klugh, Madison, Mo. App. filed Aug. 3, 1909. Insulator for telegraph wires consisting of sections through the center of which the wires run, the sections being clamped together by a fork, whose prongs are screwed together by a bolt.

971,623. ELECTRIC SWITCH; W. S. Mayer, Philadelphia, Pa. App. filed Jan. 2, 1907. A two push button switch in which the switch member is mounted upon a pivot and co-operates with contact springs on opposite sides, the springs being reversible.

971,641. ART OF ENAMELING METALS; G. L. Rice and B. W. Gilchrist, Woodhaven, N. Y. App. filed Feb. 2, 1909. Interposes between the body of the article and the enamel a binding of magnetic material and sulphur.

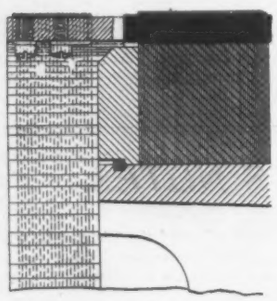
971,648. ELECTRIC SWITCH; S. P. Watson, Brooklyn, N. Y. App. filed May 3, 1909. For indicating the movements of an elevator car by means of two lamps, one "up" and the other "down," a normally open circuit for the lamps and a normally open two-armed switch for closing the circuit, the switch being operated by the car.

971,649. INDUCTION-MOTOR; J. E. Webster, Pittsburg, Pa. App. filed July 6, 1908. The secondary member includes conducting bars and conducting blocks secured between the ends of the bars.

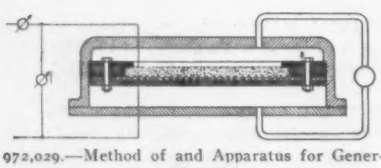
971,650. PARTY LINE RINGING KEY; A. H. Weiss, Chicago, Ill. App. filed Feb. 17, 1906. The ringing key contacts are normally removed from the talking circuit and electromagnetic means connect the contacts with the talking circuit during the operation of ringing, these means preferably being also employed for opening the strands of the cord circuit back of the ringing generator.

971,651. TELEPHONE TRUNKING SYSTEM; C. S. Winston, Chicago, Ill. App. filed Nov. 17, 1906. Trunking system for use between toll cords and common battery subscribers' line with a cord circuit and a telephone line, a source of direct-current connected with the incoming end of the trunk, a ringing key for the cord circuit and a ringing relay actuated by the change in the direct-current caused by the ringing key, the current flowing through the trunk line.

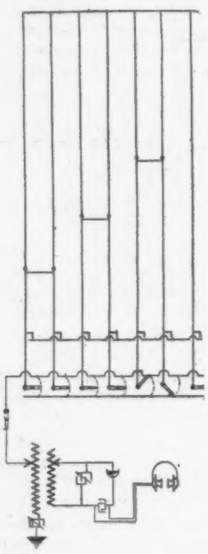
971,667. ELECTRICAL CONDENSER; W. W. Dean, Elyria, Ohio. App. filed Oct. 25, 1909. Strips of insulating material with thin layers of conducting material deposited thereon, which is dissipated at punctures and a strip of metallic foil of low resistance all wound together.



971,649.—Induction Motor.



972,029.—Method of and Apparatus for Generating Electricity.



972,004.—Antenna.

971,683. INSULATOR; H. R. Markel, Columbus, Ohio. App. filed Aug. 13, 1909. A block insulator of two sections mating together with a central orifice and opposing wire receiving recesses at different elevations.

971,684. FIRE-ALARM; W. C. Matthias, Reading, Pa. App. filed March 9, 1909. A main circuit with an independent special alarm circuit; a signal mechanism for the main circuit and separate mechanism for the special circuit, with an independent local alarm for operating the same.

971,690. ELECTRIC-CURRENT GENERATOR; H. A. Schmidt, Chicago, Ill. App. filed Jan. 31, 1910. A miniature generator with multiplying gearing and a permanent magnet with projections constituting a field and diamagnetic plates bridging the projections above and below the field, and an armature driven by the gearing.

971,692. MAGNETIC SEPARATOR; F. O. Schnelle, Frankfort-on-the-Main, Germany. App. filed Oct. 9, 1902. An iron-clad magnet having an attenuated zone of magnetic material forming an isthmus between the poles gradually decreasing in the direction of the flow of the material to be treated, with means for feeding the material to the zone.

971,722. ELECTRICALLY OPERATED VALVE; P. A. Brown, Denver, Col. App. filed Oct. 18, 1909. For use with alarm and signal whistles, ventilators and the like, in which a resilient diaphragm divides a chamber into upper and lower compartments and a magnet controls a cover for the outlet of the upper compartment.

971,737. VENT-TUBE FOR STORAGE BATTERIES; Melcher Ekstromer, Cambridge, Mass. App. filed March 31, 1909. A vent for the escape of gases and a plunger enclosed with the tube constructed to rise and close the vent by the impact of the liquid of the battery against the plunger.

971,767. THERMO-ELECTRIC COUPLE; A. L. Marsh, Detroit, Mich. App. filed Sept. 3, 1909. The positive element consists of an alloy containing nickel and two per cent of aluminum.

971,776. BURGLAR ALARM; L. Myers, Newark, Mich. App. filed Nov. 9, 1909. A circuit wires the doors and windows and a pivoted arm carries contact members at each end with elastic fingers in the paths of the members, the circuit being completed through the fingers, and a lock holds the pivoted member in inactive position and a strand or cord extends from the lock to the point to be protected.

971,782. METHOD OF CHARGING ELECTRIC-RESISTANCE FURNACES; A. Petersson Odda, Norway. App. filed Nov. 27, 1909. Furnace of the shaft type having electrodes of different polarity in the walls in which a part of the charge is introduced from above, while a charge of cold material is introduced between electrodes of different polarity to maintain a cold layer on the wall in the hot zone, thereby preventing short circuiting through the walls.

971,785. TREE INSULATOR; A. L. Pierce, Wallingford, Conn. App. filed April 21, 1910. An insulator to be attached to trees for holding a wire, the insulator being made in two parts between which the wire is clamped.

971,795. MAGNETIC BRAKE; C. Shears, Manchester, England. App. filed Jan. 21, 1909. Includes side plates, coils thereon, casings surrounding them, pins for holding the coils in position with a watertight packed joint between the casings and the plates.

971,820. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINES; B. A. Behrend, Norwood, Ohio. App. filed Nov. 27, 1905. A stator with a winding of coils having end turns arranged at two different angles to the axis of the machine, the end turns being clamped at one angle and separate means for clamping the end turns arranged at the other angle.

971,843. ELECTRIC SWITCH; L. W. Horting, Lancaster, Pa. App. filed Dec. 14, 1909. When the electric current is broken the arcing is reduced to a minimum by a quick and positive movement of the switch, which switch can be set to various points necessary for current regulation, the switch including an operating lever, a cam operated by the lever and engaging a roller mounted for wabbling movement with relation thereto.

971,847. SWITCH AND CIRCUIT-BREAKER FOR HIGH-POTENTIAL CIRCUITS; J. N. Kelman, Los Angeles, Cal. App. filed July 29, 1908. Makes use of a plurality of solenoid coils in the main circuit moving a soft iron core to operate a circuit closer in the auxiliary circuit which controls a soft iron core which releases a catch engaging a lever against which a spiral spring presses upward, which pulls the movable blades of the high-potential circuit-breaker of an oil switch.

971,864. MOVING-PICTURE PROJECTING LANTERN; W. N. Selig, Chicago, Ill. App. filed April 20, 1909. Arc light lantern in which the carbons can be swung out of the box, protection against flying sparks being provided.

971,868. DYNAMO-ELECTRIC MACHINE; R. B. Williamson, Milwaukee, Wis. App. filed Oct. 29, 1909. For anti-hunting devices for synchronous machines, the field magnets having poles with coils surrounding them and a collar at the outer end of each field having a portion between the coil and the coil-retaining portion on the pole with damping bars extending through the poles and secured to flanges, which flanges carry short-circuiting rings.

971,869. DYNAMO-ELECTRIC MACHINE; R. B. Williamson, Milwaukee, Wis. App. filed April 8, 1910. For preventing displacement of coils at high speeds by means of bracing members bearing against the sides of the coil and located between adjacent field magnets and annular members mounted on the shaft at the ends of the core to which the bracing members are connected.

971,935. SPARK GAP FOR RADIOTONE WIRELESS-TELEGRAPH SYSTEMS; E. J. Simon, New York, N. Y. App. filed March 17, 1910. For producing powerful electric oscillations, with spark gaps including a plurality of disk electrodes with thin rubber gaskets between to form short airtight sparking spaces.

971,961. TELEPHONE RECEIVER HANDLE; C. A. Barnes, Sr., Greenfield, Ind. App. filed June 3, 1910. A removable handle with a holder portion holding a receiver between its end and a handle portion extending at an angle therefrom to be inserted between the ends of a telephone hook so as to support the handle on the hook and the receiver on the handle while the latter is on the hook.

971,976. SECURING MEANS FOR ELECTRIC LAMP SOCKETS AND THE LIKE; J. S. Crossley, Solvay, N. Y. App. filed Sept. 1, 1909. A securing bolt and an engaging nut having opposite integral downward extensions with the tips bent to clamp the nut on the body.

972,004. ANTENNA; Robert H. Marriott, Brooklyn, N. Y. App. filed April 8, 1910. A plurality of antennæ having different natural periods any of which may be used for receiving and all together for sending, so that the operator may tune by connecting that particular antennæ in circuit to which the receiving tuner best responds and by which interference is prevented by grounding the antennæ which respond to the interfering waves.

972,007. AUTOMATIC DANGER-SIGNAL AND INTERMITTENTLY ILLUMINATING ADVERTISER FOR ELECTRIC CARS; A. May, New Orleans, La. App. filed June 16, 1909. Operates a display sign from the controller handle and also a signal to warn passengers when alighting from a car.

972,029. METHOD OF AND APPARATUS FOR GENERATING ELECTRICITY; B. Schwerin, Frankfort-on-the-Main, Germany. App. filed May 12, 1909. A layer of coal with minute apertures through which an electrolyte is forced and electrode plates for collecting the current.

972,048. INDICATING SWITCH-BUTTON; J. A. York, Franklin, Conn. App. filed Feb. 17, 1909. A thumb button with an indicator within the button.

972,109. MAGNETIC ORE-SEPARATOR; A. G. Holmberg, Langgruf-van, Sweden. App. filed Nov. 27, 1908. A trough in which the ore is carried in water with a belt running in the trough and electromagnets above the belt.

972,114. TELEPHONE MOUTHPIECE ATTACHMENT; A. P. Levi, H. and M. Schlessinger, San Francisco, Cal. App. filed May 12, 1909. Antiseptic attachment fitting the mouthpiece on the outside, the mouthpiece being perforated so as to permit the disinfectant to pass through the perforations into the mouthpiece.

972,131. ELECTRICAL HEATER; H. M. Schoenberg and G. T. Marsh, San Francisco, Cal. App. filed Jan. 28, 1909. For heating water, using a single pipe for hot and cold water, the heater being immersed in the branch of the pipe.

972,141. FUSE BATTERY; A. E. Porter, Pompton Lake, N. J., and E. P. Searing, New York, N. Y. App. filed Jan. 27, 1909. For blasting purposes, including a generator, contacts arranged in pairs, each pair connected to a fuse, and electric circuit including the generator and contacts, an arm to complete the circuit to each pair in sequence and means for giving the arm a step-by-step movement.

13,154. DEVICE FOR SINGEING TEXTILE FABRICS; G. Gin, Paris, France. App. filed July 16, 1910. A pair of electrically heated bars with a movable conducting member for short-circuiting the bars and limiting the extent of bars heated.